Vol. III.] JULY 1911. [No. 1.

THE POONA AGRICULTURAL COLLEGE MAGAZINE

POONA

PRINTED AT THE "ARYA-BHUSHAN" PRESS, AND PUBLISHED AT POONA

By

Vishnu Narayan Gokhale.

1911.

THE

POONA AGRICULTURAL COLLEGE MAGAZINE.

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B. S. PATEL,
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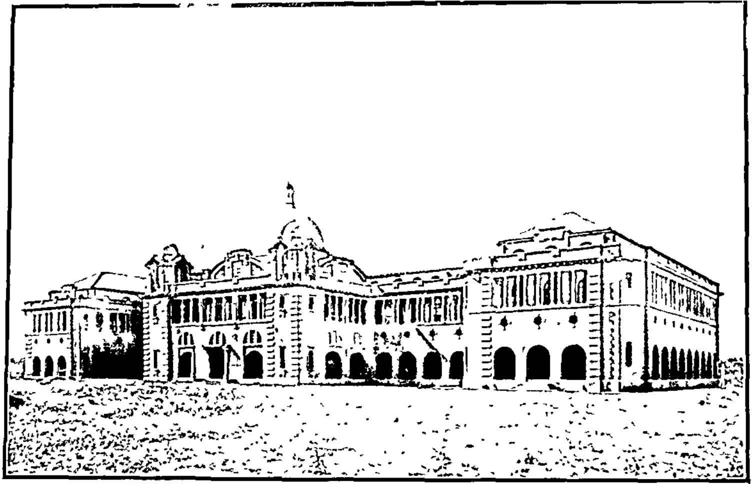

Poona Agricultural College —*Main Building, Opened July 1911.*

The Poona Agricultural College Magazine.

Editorial.

WITH this number we commence the third volume of the Poona Agricultural College Magazine. And in doing so we have to congratulate ourselves on the increasing appreciation which it has had not only among the students and past students of the college, but also among the general public interested in agriculture. The accounts for the second year published in the present number show a healthy financial position, which itself shows that what was originally designed as a means of intercommunication on technical matters between the college and its *alumni* has become already considerably more than this.

The third volume is commenced, however, with much trepidation. The editor and manager who have piloted the venture through its first two volumes have now left us. Their work has been invaluable in placing the venture on a sound footing. And we, their successors, only hope to be able to continue in the path which they have marked out. The magazine will still try to maintain its severely practical tone. It will welcome accounts of personal experiences and observations, whether in the Bombay Presidency or outside. It will be always open particularly to descriptions of personal experiments which have the object the elucidation of agricultural problems, the removal of present difficulties, or the introduction and development of yet unrecognised methods or crops,—however small the detail with which these are concerned. And we conceive that if this is maintained as the characteristic feature of the magazine, the appreciation and support which it has already received will not be wanting in the future.

The present number will be found, we think, to be an illustration of this policy. Thus, for instance, we have three articles on rice cultivation. In one of these Mr. Padwekar, now of Khed in Ratnagiri, discusses the general manner and methods of rice growing in the districts which he personally knows; Rao Saheb G. K. Kelkar gives an account of a series of very important experiments in the Konkan for reducing the area which it is necessary to devote to the seed bed in growing

transplanted rice,—and so economising the seed rice, which at present, forms a much larger amount per acre than is probably necessary; and thirdly Mr. K. V. Joshi records his experiences in combating that enemy of rice cultivation, and particularly of the rice seed bed,—the land crab.

The same practical character will be seen in the paper on six weeds of Southern Gujarat, we are convinced that the study of weeds is important for the agriculture of Western India, and we are indebted to Mr. Keatinge for allowing the reproduction of this paper,—a summary of a prize essay contributed by several past students as a result of their personal study in the Surat district.

There are two further papers on the question of improving cattle and increasing their number. One of these,—that by Mr. R. S. Hiremath,—was inadvertently omitted from the last number of the magazine,—but in the meantime it has been looked over and improved by its author. The other, by Mr. K. M. Pawar, is by one who has lived all his life in close touch with the actual problems he discusses, and whose opinion is, therefore, entitled to considerable weight.

A new type of article is that by Mr. B. S. Patel on Gujarat proverbs relating to agriculture. We could do with many articles of this sort. There is an immense amount of experience enshrined in the proverbs and customary sayings of a people, and we hope that not only will Mr. Patel furnish us with a further selection at a later date, but that others may be inspired to form a similar collection for other regions in which their work more particularly lies.

The other articles need no special reference: we send forth the magazine feeling that it will be found useful in many directions, and with our very sincere thanks to those, chiefly past students, who have placed the treasury of their experience at our disposal.

We must refer to one more point. Among the college students who have just graduated, there are those who come from parts of India as widely separated as the extreme north east in Upper Assam, and from the extreme west, on the borders of Baluchistan. To these widely separated representatives of our college, as to all others, we offer our hearty congratulations on the position they have already achieved. May it, however, be only the beginning? By sterling work, by untiring energy, by a determination to be thorough and accurate in all they do, may they go forward from success to success. And may this magazine be always a bond which will bind them to their *alma mater*!

The late Rao Bahadur Mallappa Basappa Varad.

BY

D. L. Sahasrabuddhe, B. Sc., L. Ag.,

Lecturer in Chemistry, Poona Agricultural College.

PHILOSOPHY and science agree with each other at least in one respect inasmuch as philosophy says 'Example is better than precept,' and science also gives greater respect to a practical man than to one who has not gone beyond the pale of book knowledge. Why do we read and study the lives of great men? Not because philosophical works do not tell us to live a life of high morality, not because poetry does not teach us to appreciate nature's beauty and not even because the preachings of great men do not teach us to do our duty, to work for our own and our country's good and raise our nation to a higher level, but because the lives of great men are examples and *illustrations* which convince us that what books say is not mere theory and can be brought into practice and acted upon if we wish to do so.

Rao Bahadur Appa Saheb Varad was a great citizen and a patriot, a man of culture and of high moral character, and a man of liberal charities. He took a very prominent part in all the activities of his city—Sholapur, was a great leader in commerce and from our point of view, above all a pioneer in scientific agriculture. His life was an exemplary one in all its aspects and is well worthy of close study by our young men. It is beyond the scope of our magazine to deal with all the aspects of his life and hence I must restrict myself to his activities as a leader in commerce and especially as a pioneer in scientific agriculture. Yet it will not be out of place to mention a few of the important facts in the life of Appa Saheb Varad.

Rao Bahadur Mallappa Basappa Varad was born on the 17th of June 1851 at Sholapur. His father, Basappa, and his uncle Chanabasappa were born of poor parents. They opened small shops at Sholapur, but before long, by hard work and their skill in commerce, became rich and prosperous. Especially Chanabasappa rose to such a high position that he became an acknowledged leader in commerce at Sholapur—then, as now, a great commercial centre,a—nd commanded *so much respect from the people that he was considered to be a Sadhu.* Chanabasappa had no issue and Appa Saheb was the only son of his

father. He, hence, naturally succeeded both his father and uncle. In his childhood Appa Saheb learnt to read and write, but was not allowed to learn English as his father and uncle thought that by learning English he would be converted to the Christian faith. Although he did not pass any examination yet he was highly educated in the proper sense of the word 'Education.' He received his training in commerce at his uncle's shop where he was brought up under strict discipline.

When Appa Saheb was about twenty-five years of age his uncle died and he, from this time, had to carry on the whole business on his own responsibility. His business went on increasing and flourishing and he became more and more prosperous every year. He soon extended his operations to Bombay, where he opened a branch which he ultimately made a great success. When his Bombay branch was put on a firm footing he went on visiting the Bombay mills and studying them in detail. This he did very regularly for about six months, and with the help of Rajbahadur Gyangirji he establised the 'Narsinggirji cotton mills' at Sholapur in 1899.

Appa Saheb knew full well that mere commerce unconnected with agriculture only means the very partial development of a country. Real commerce does not mean carrying things from one place to another or doing the business of a broker, but the commodities must be produced with which commerce is to be carried on. On the other hand he felt that it is little use simply improving the staple food crops of the country and that it is, at the present stage, perhaps more important to introduce and develop those crops like indigo, cotton, sugar-cane, etc., which will bring a large money return to the cultivators, establish agricultural industries in the country, and keep agriculture connected with commerce.

Appa Saheb had a great liking for agriculture. When he started work in that line in the year 1882 he had only a small area of land, but by degrees he increased this so much that at the time of his death he owned four thousand acres of land and three hundred bullocks, paid three thousand four hundred rupees as assessment and about eight thousand rupees as irrigation charges annually. He was not only fond of agriculture but studied very carefully the indigenous methods in vogue, and always considered these as the basis for any improvement he might undertake by the application of a more advance system. He was fully convinced, however, of the possibility of improvement, and devoted himself continually to bring it about, accepting suggestions and ideas from any source in which he could find them. He was hence always close touch with the agricultural department and its officers. When-

The late R. B. Mallappa Basappa Warad.

Born 17*th June*, 1851] [*Died* 19*th January*, 1911

ever he learnt that a particular method or implement was useful or labour-saving he at once tried it on his area and if it proved to be successful he brought the neighbouring cultivators to his fields and demonstrated its use to them.

With the object of growing industrial crops he brought indigo seed from Madras, grew the crop in Sholapur and extracted indigo which was valued at a high price in the Bombay and Calcutta markets, but the introduction of artificial indigo from Germany gave a blow to the indigo industry of India and this crop had to be abandoned.

Then he directed his attention to sugar cane. He tried a number of varieties, experimented with various manures, tried different methods of crushing and boiling. He was the first man to use a power crusher in the Deccan. He demonstrated its work to the agricultural officers who then finding it to be useful introduced it on the Manjri farm. He tried experiments to economise fuel in the furnaces for boiling cane juice. He constructed ten to twelve furnaces in line, the excess of heat from the first furnace was taken to the second one and from the second to the third and so on, there being a large chimney at the end of the last furnace. He increased his sugar cane area so much that he thought of preparing sugar, and ultimately a small sugar factory was started. This, however, was not a success, and was ultimately abandoned.

He often visited the Government experimental farms and if he saw anything useful there he at once introduced it on his own estates. When he found that his results in sugarcane did not agree with those of the Government farms he offered to the agricultural department a plot and to pay all expenses in order to see whether their results could be obtained under the conditions of his estates. This shows how very keen he was and how he liked to be convenienced by actual experiment.

When the 'Narsingagirji Mills' were started in 1899 there were only ten thousand acres under cotton in the Sholapur district but, seeing the importance of the crop, he wrote pamphlets giving the best methods of cultivating cotton and showing what a very profitable crop it was. The pamphlets were given free to the cultivators of the Sholapur district. He also brought seed of Dharwar—American and other varieties of cotton and distributed it among the cultivators. The vast area of about four hundred thousand acres under cotton in his district is due in part, at any rate to the efforts of Appa Saheb.

Groundnuts hitherto grown in the Deccan are an inferior type, and great efforts have been made recently by the Agricultural Department to replace this variety by various types of foreign groundnuts. The

cultivators are naturally averse to anything new but they had full confidence in the subject of this article. When he was induced to try these foreign varieties on his estates, and proved that they were better than the country variety in every respect, they were taken up quite extensively in his district.

In order to encourage his own men to do good work he allotted plots to his *mukadams* and at the end of the year gave silver bracelets to those whose plots showed exceptional returns.

He was of great help in all efforts after agricultural development. When exhibitions were held at Sholapur he lent his men, bullocks and implements to the organisers. When his specimens won prizes, he, instead of taking them for himself, gave them to other cultivators.

Although Appa Saheb was devoted to commerce and agriculture yet he was a man of many activities and in many respects was a man of progressive views. He had not received an English education himself; yet he very much wished that his countrymen should have the best possible opportunities in this direction, even, if necessary, by going to foreign countries. He encouraged Sanskrit learning also. He spent about five hundred rupees a month for a Sanskrit school at Sholapur and published many religious books for the Lingayat community.

In charities Appa Saheb spent his money without stint, helping every institution in the Deccan without any distinction of caste or creed. He was the centre and leader of every public movement at Sholapur. He was of opinion that to reform the whole nation every community should strive to reform itself and with this view he started several movements and institutions to advance his own people,—the Lingayat community.

His public-spirited activity was acknowledged by the Government, and he was created Rao Saheb in 1900 and Rao Bahadur in 1910.

He died on the 19th January 1911 at his own home in Sholapur. The news of his death spread at once throughout the city of Sholapur. All the Government courts, the Agricultural Exhibition, the market and all the shops were closed in his honour and there was general mourning throughout the whole of the city and much of the district. He was a man whom we could ill afford to lose,—a great and public spirited citizen. May his soul rest in peace.

Six Weeds of Southern Gujarat.

[The article which follows is a summary of a prize essay submitted to the Director of Agriculture by several old students and graduates of the Poona Agricultural College and stationed at Surat. The whole essay is too long for publication in this magazine, but as it contains a considerable amount of important information, it is felt that this information should be made generally available. The authors, *of the original essay are* Messrs. K. B. Naik, K. D. Naik, D. N. Desai, R. R. Desai. Eds]

The characteristics of Southern Gujarat as an agricultural district are well-known. Its stiff black soil, derived from the basalt rocks of Western India, the industry of its cultivators which makes it one of the gardens of India, the fact that its products, and perhaps most notably its cotton, stand second to none in their own way through the length and breadth of the country and combine to give it a character of its own which is well worthy of very close examination.

The weeds which are prevalent in such a district are, either such as are of universal occurrence or the consequence of these peculiar characteristics. Primarily they depend, of course, on the nature of the soil,—the more or less stiff black *regur* of the district,—and of the climate which presents the usual characteristics of the region chiefly dependent on the south west monsoon for its rainfall.* But the weed herbage also depends on the character of the cultivation, and the study of the weeds of a highly cultivated district is by no means devoid of interest from this point of view.

The six weeds with which the present paper deals are among the most noxious in Southern Gujarat. They are as follows :—

1. *Dabhdo*. — (*Eragrostis cynosuroides*)
2. *Darci*. — (*Cynodon dactylon*)
3. *Khara*. — (*Andropogon intermedius*)
4. *Gunderdo*. — (*Scirpus maritimus*)
5. *Jowasa*. — (*Alhagi maurorum*)
6. *Dhudi*. — (*Eragrostis interrupta*)

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* The average rainfall at Surat is as follows —January, February, March and April—0 40 ins. May—0·03 ins., June—8 00 ins., July—16·32 ins., August—7·45 ins., September—5·31 ins., October—1·86 ins., November—0·13 ins., December—0·08 ins., Total—37·58 ins.

Dabhdo (*Fragrostis cynosuroides*).

In botanical characters this grass is very similar to other plants of the same genus. With *fibrous roots, it has a subterranean stem* system enormously developed. The stems, in fact, often penetrate the soil to a depth of from five to seven feet. The part of the stem above ground is hollow, and like similar grasses is encircled by a sheath of leaves. These leaves are alternate, with very long leaf stalks, while the ligule at the base of the leaf proper is tough, minute, and very hairy. The leaves themselves are thick and rough with a very cutting edge, and are of great length. The inflorescence is a compound spike, composed of flowers with no true perianth, its place being supplied by impricated bracts, two in number, called glumes. The fruit is a caryopsis, yielding small black seeds.

Dabhdo is a perennial plant growing to a height of two to three feet. As a rule, the underground stem (which is the most characteristic feature of this grass) grows horizontally but in dry conditions it *often proceeds directly downward, evidently in search of water. This* habit renders it evergreen and drought resisting. Year by year the depth and range of its roots increases, and so it forms continually increasing patches growing onward from one centre.

The weed has no definite flowering season, but our observations indicate that it flowers and seeds most profusely in the rainy season, that is to say in the months of July and August. The growth of the plant is, moreover, much more rapid in the monsoon,–the total time from sowing to the production of ripe seeds being from sixty to sixty-five days at that time, and seventy to eighty days either in the cold (October—February) or the hot weather (March—May). The seed is disseminated chiefly by wind, rain, birds and cattle, and being very numerous, the weed spreads very rapidly. Under ordinary cultivation, the majority of the young plants share the fate of other shallow-rooted weeds, while the few that remain become very difficult to eradicate.

When a plant has had opportunity to produce an extensive underground stem system, these stems grow so strong and entangled with one another that when an attempt is made to drill seed among them, the lines of the drill are often broken during the sowing operations. The cultivators often, if not usually, neglect such established patches owing to the extreme difficulty of cultivating among the underground stems, and the great cost of digging out the weed. The extension of the underground system takes place most vigorously in the monsoon, as would be expected,—and, in fact, only the longer stems, with many branches, give off fresh off-shoots during the hot weather.

Though a noxious weed it is not without its uses. The leaves, being long and tough are considerably employed in making baskets, brooms and brushes. The local cultivators use them also in preparing packets for storing grain,—and curiously enough, the whole plant is considered as holy by the Hindu population. The finely pounded flowers are much esteemed as a medicine in cases of cataract. The plant is of little use, *in the raw state, as a fodder grass, on account of the very sharp cutting* edges of the leaves.

The seriousness of this weed is becoming annually greater on *account of the increasing shortage of labour*, and the fact that since the great famine (1900—01) the work cattle have been deficient. The weed appears, therefore, to have obtained hold during the past ten years greater than it has had for a long time previously.

The methods which are employed, at present, by the people in dealing with this weed are as follows :—

1. Where there are only scattered plants, no effort is usually made to dig out the weed. But previous to sowing, at the break of the rains, the land is harrowed with a heavy harrow at a cost of ten to twelve annas per acre. The weed then breaks off about three inches below the surface. This will give a respite of about six weeks.

2. In more serious cases, and where patches are formed, the only method in use is ploughing deeply or digging out in some other way. In ploughing, the country plough is used at the end of the rains. It lays open the surface soil, and removes the foliage and underground stems where it touches them. The deeper and vertical roots are missed altogether. For complete eradication it is generally felt that the weed *must be dug out by hand*.

We have made several observations and experiments as to the action of various agents on the weed. From superficial observations made in the Jalalpur taluka (Broach District) in three cultivators' fields, it was noticed that where a cart of cattle manure had been emptied over a patch of *debhdo*, the foliage died away after a fortnight. It is probable that much more manure was left there than was received by most parts of the field. A similar effect in the dying away of the foliage was observed when plants were treated with basic slag. This experiment was, however, only conducted with a few plants. If a small piece of asafaetida and catechu be introduced into a slit made in the stem of a plant, the latter withers. This has probably no direct practical application, but is worthy of note.

If a rapid growing crop like *jowar* can be given a start such as will deprive the weed of air and light necessary to luxuriant growth, it will be checked considerably. If the foliage be burnt off from a field badly overrun with the weed, the growth will be temporarily checked, but we have no information as to its permanent effect.

The most effective system we have found consists in deep ploughing at the close of the rains with a Ransome's C. T. 2 plough or its equivalent. This can best be done in November or December when the ground will not yet have become hard. If the plough is so adjusted as to go in to a depth of nine or ten inches, it will remove the weed from five or six inches deeper than this, or say from fifteen inches deep. If the field is then left exposed to the sun the clods turned up will loosen, and so dry off the uprooted stems. A harrow, just at the break of the rains will complete the breaking up of the clods, when the fragments can easily be picked up and burnt. The C. T. 2 wheeled plough is specially recommended for this work on account of its steadiness. It will require three and a half days to plough an acre of land infested with weed. The expenses per acre, for this ploughing will be

2 pairs of bullocks, $3\frac{1}{2}$ days at Rs. 1/-/- per pair	Rs. 7-0-0
Labour charges of two men for $3\frac{1}{2}$ days at 4 annas. each	Rs. 1-12-0
	Rs. 8-12-0

If the soil is fairly loose after ploughing, the fragments of the weed can be cheaply collected by working a *dantala* or tined harrow with a wooden stick tied across the tines six to eight inches above the points. The working of the country *lanta* will also collect them rapidly. If any plants survive this treatment repeatedly applied, they must be dug out by hand,—at present we know no other method.

The only alternative to the method above described is to dig out the weed by means of a pickaxe or a heavy iron bar pointed at one end. This operation will require about two hundred hands per acre for one day, or a cost of at least Rs. 50/–, while Rs. 10/– more will be required to crush the clods and level the land again for cultivation.

Daru or Hariali (Cynodon dactylon)

-- This grass is one of the commonest of Indian grassess, and for this reason a detailed botanical description is quite unnecessary here. It abounds almost all over the Presidency and is by no means confined to Southern Gujarat. It is the principal grass in natural pastures (*kurans*) over Western India, and is intentionally grown in many cases for its

high nutritive value as fodder. It is, moreover, a fairly good grass for lawns and is used as a treading grass along the sides of drain. In fact, it is only in cultivated fields that its presence is undesirable and it can be termed a weed. It is used by Hindus in the worship of the God Ganesh.

Like so many of the grasses which figure as serious weeds this is provided with a system of underground stems, and long numerous fibrous roots strike from each node, going very deep. This goes on until a patch or colony of the weed is formed, with a depth of from eighteen inches to two feet. There are two distinct types of plant, one with a much thicker stem and broader leaves than the other. The former is much more vigorous and more capable of extending its range than the latter.

The plant, which is perennial, flowers as early as July and has probably only one flowering season, though this is not at all strictly defined under ordinary conditions.

The eradication of the weed is difficult. On account of its very thin stem and very long roots, if an attempt is made to pull it up, the underground stem invariably breaks off. Some portion being left, new plants are produced. The only method of dealing with it is to work the soil very deeply in December in the case of black cotton soils, just after they begin to crack slightly,—or in February and March in *jorab* or *besar* soils. The network of underground stems is thus broken to pieces directly or indirectly by the plough. The pieces will dry and lose vitality in the hot weather, and if the process is maintained year after year, the weed will gradually disappear. The annual expenditure required will be from Rs. 6 to Rs. 7 per acre. It is of course, more effective to dig over the patch with a pickaxe in March or April, but it is much more expensive.

Khaca or *Londa* (*Andropogon intermedius.*)

The botanical characters of this grass, which is essentially a weed of rich soils, are very well defined. The roots are fibrous and penetrate the soil to a depth considerably over six inches from their point of junction with the underground stem. The underground stems are often from three to five feet long, and are stout, flattened on one side, with very short internodes. The terminal point of the root is very strong and pointed, and very sweet in taste.

The stem above ground is sheathed with the petioles of the leaves which latter have very short ligules. The leaves themselves, are

narrow about one foot long and a quarter of an inch in diameter at the middle. The inflorescence forms a panicle three inches long, the spikelets being purplish green in colour. The flower has no true perianth its place being taken by glumes. The fruit is a caryopsis.

It generally occurs, like the two grasses previously considered, in patches and in fields,—but solitary plants are not uncommon. It is widely distributed in the Bombay Presidency in all classes of soil, and under all the normal climatic conditions. It is a perennial grass growing to a height of about three feet, with, as already indicated, strong underground stems. Its habit differs from *dabhdo* in the growth of the underground stem being more horizontal and constructing a network as it develops. The growing end of the underground stem curves upwards with a pointed end and gives rise to a shoot. At the same time another branch is developed underground at the same point of the stem. The foliage springs directly from deeper layers of the soil than in the case of *dabhdo*. It is, on account of this manner of growth, more difficult for new plants to arise from the nodes in the underground stem but they are produced very easily from its growing point. The shoots given off by the underground stem of *khara* are much more numerous than with *dabhdo*. The network of roots extends to a depth of from two to two and a half feet.

It forms a useful thatching grass.

The most practical and effective methods for the removal of this weed are practically the same as already mentioned in the case of *dabhdo*. The most complete and effective is the removal of the whole plants by hand digging. Next to this comes the use of the iron plough as already described. It will uproot the underground stems fairly easily as they are always much entangled with one another. They are, however, much more brittle than those of *dabhdo*, but have less power to revive if once exposed on the surface. Light and air are required by this grass, and hence it will be discouraged by the growth of rapid shady crop. Drainage will help matters and the avoidance of a swampy or even very moist condition in the soil.

Gunderdo or *Lowala* (*Scirpus maritimus.*)

This is another weed, of habit closely similar to those already discussed. Its stem is again partly subterranean and forms what might be called rhizomes from these branches are put out, and in their turn give rise to independent plants. The aerial portion of the stem is solid, angular and unjointed. This, as is usual with members of the order *Cyperaceae*, is the flower-bearing stalk which is closely encircled by sheathing leaves.

The leaves nearly approach the flowering stalk in height and are leathery in texture. They have no ligule. The inflorescence is a compound spike, while the flowers are perfect, arising from an axil of three bracts or glumes. The fruit is one seeded and indehiscent, and the contained seed is black, shiny, round and about as big as a poppy seed.

The plants flower in from forty to forty-five days from sowing, and the seeds ripen in about sixty to sixty-five days. The effect of the plant is very similar to that of the grasses already described. It forms a tangled mass of underground stems, extending to a depth of eighteen inches. This mass is more like an underground mat, impenetrable to the roots of a growing crop.

The plant has, however, its local uses. The roots, for instance, which are fragrant are used most extensively in scenting hair oil, and also in the religious ceremonies of Hindus. They are also employed as an astringent *in the treatment of swellings,—and are likewise prescribed as a* diuretic. The leaves are used in the preparation of mats, and baskets by the labouring classes.

Wherever farmyard manure is applied, these plants of *gunderda* appear. This is due to the practice of putting all the weeds in the manure pit, which of course ensures that seeds are carried with them. The seeds of this plant do not easily rot, remain capable of germination, and hence cause the spread of the weed. This indicates a danger which is not always sufficiently considered, and it may be, in spite of the apparent waste, that the best way of treating gathered weeds would be to burn them. It has the greatest chances of becoming established in the irrigated areas, as it is extremely partial to moist and even to swampy land ; owing to the rapid growth and fruiting of the plant, its spread is very rapid if once it gets established.

The recognised methods of dealing with this weed are the same as those already indicated for the grasses previously dealt with. If land be badly affected, it is essential that irrigation be avoided, and it would often pay to leave such land fallow and repeatedly plough it over, and collect the roots and rhizomes after every ploughing. A crop of *sann*, in the monsoon, which will crowd out the weed will probably also do good, especially if it be ploughed into the land, and the exposed stems and rhizomes collected at the same time. These are, however, little more than suggestions, as experiments have not been undertaken on the subject.

Jawasa or *Camel thorn(Alhagi maurorum).*

This is the first leguminous weed which has been dealt with in the present paper. It forms a thorny shrub, which yields 'Persian manna'

by merely shaking the branches. The leaves are alternate, with stipules, arising from the axil of the spine. The calyx is monosepalous, and the corolla that typical of the *papilionaceae*.

It is found generally in black soils, in fields, especially in the low-lying area near the banks of rivers. When found in light soils it particularly occurs where there is a bed of *kankar* (nodular carbonate of lime) underlying the soil. It occurs extensively in local patches in rice beds.

The camel thorn, as it generally occurs, forms a perennial shrub growing to a height of from two to three feet. The plant branches freely and quickly covers a considerable area. Owing to its spiny character it becomes a nuisance, and men and animals are often injured by the spines during the rice puddling and transporting season. The seeds are shed before the monsoon, but few of them germinate during the succeeding wet months. What plants do grow, are generally eradicated in the succeeding agricultural operations.

The aerial parts of the plants die off early in the rains. The roots are very strong and deep and generally penetrate till they find underground water. The plant is, however, very sensitive to waterlogged conditions, when the stem and branches wither and die off. The root will retain its vitality, however, for a long time, and throw up new branches when dry weather again appears.

Even this thorny shrub is of considerable local value. It forms a very fine hedge if kept in strict control. When cut down it is one of the favourite materials to form curtains with water dripping over them, for cooling houses during the hot dry weather.

Where land can be inundated durinng the rainy season, such inundation is very effective in destroying the plants. If the water is kept on the land for three or four days, the part above ground will decay, but it takes much longer to destory the vitality of the roots. Of course the application of the *rab* process to a patch where it occurs is very effective in removing it or destorying the seeds. But naturally, this process can only be applied to a small portion of the land.

The cultivators dig it out, as a rule, to a depth of nine inches, but this is not an effective eradication, as the plant comes up again from the deeper portions of the root left in the soil. The use of the iron plough at this depth is likewise not permanently effective. In fact no method is known of getting rid of this noisome weed, except digging out with a pickaxe or crowbar to a depth of three feet.

Dhudi (*Eragrostis interrupta*)

We come finally to the sixth weed of the present series. It is again a grass, very common not merely on the typical soils of Southern Gujarat, but on lands of all classes especially in low-lying damp places.

Belonging to the same genus as the *Dabhdo*, its botanical character is closely similar to that weed. Its inflorescence is, however, a panicle whose branches rising from almost the same spot give the whole a somewhat articulate appearance.

It is an annual plant, growing to a height of two to three feet. At the break of the rains, the seeds shed in large numbers at the end of the previous rainy season, germinate and grow very fast, each plant striking hundreds of long fibrous roots to a depth of four to six inches, so that the soil becomes "root bound." The roots of the weed in this way entangle and choke up the roots of the crop and checks its growth when young.

The weed flowers in September, and seeds in October. The seeds are very small, and retain their vitality until the following rainy season.

This grass is not considered a good fodder, but cattle will eat it when other food is not available.

Being an annual weed, the method of dealing with it would seem to be to require clean cultivation as a whole so that the plants never get a chance of seeding, rather than any *very special method*. To interculture the crop on the land as soon after the break of the rains as the soil and crop allow this to be done, is obvious as a remedial measure. The cost per acre of such a hoeing would be from 12 annas to Re. 1/-.

The Cultivation of Mangoes in the Maldha District of Bengal.

BY

S. G. Sharangpani, B. Ag.

THE information in the following article was collected during a short visit to the Maldah district which I had the opportunity to pay in February 1911. Though only a few days in the district, I took the chance of visiting a considerable number of villages in this, the most famous mango district of Bengal.

The district of Maldah is divided into two nearly equal parts, which present different characteristics, by the river Mahananda and Maldah town is situated on one of its tributaries the *Kalindri*. Hence the soil at Maldah is low lying recent alluvium enriched by annual deposits of silt, and its fertile soil is therefore well adapted for the cultivation of the crops commonly grown viz., rice, mulberry, indigo, and mangoes.

The profits from the sale of mangoes, as well as improved facilities for transport which have recently been introduced have encouraged land-owners to cultivate mangoes in all the parts of the district. Every plot of land *suitable for the growth of mango grafts is planted with* them, and tracts of land formerly growing ordinary *rabi* or winter crops have in recent years been converted into mango orchards. The cultivation of mulberry gives a curious aspect to this part of the country, as the land has to be artificially raised to the height of 8 to 10 feet to prevent the plants from being destroyed by the annual floods. These raised lands are now being converted into mango orchards.

As the mulberry fields, as well as tracts of land growing ordinary *rabi* or winter crops are gradually being converted into mango orchards, no special preliminary cultivation is required. Manure is used only on mulberry lands, the rate of manure being 750 to 900 mds* per acre of well rotten cowdung. The mulberry fields receive two or three ploughings. Before planting the mangoes into their final pits, these are dug about two feet deep and then the grafts planted are transplanted into them. No manure except fresh earth from the banks of the river is given. The mangoes are generally transplanted just when the rainy

* Maunds of 80 pounds are meant in the present paper. (*Eds.*)

season is nearly over. Vegetables, *aus* paddy, mustard, mulberry and turmeric are grown in the plantation while the trees are young. Preliminary cultivation i. e. ploughing, harrowing &c. is given to these crops and after the fruiting time is over the field is ploughed once or twice.

The varieties commonly grown are *Fuzlee, Gopalbhog, Krishabati, Brindabanee, Lambabhaduria* and many others. As this was not the season I could not get the specimens and hence the details as to the size, shape, colour, keeping qualities &c. will be given in a later paper.

Formerly mangoes were transplanted at a distance of twenty to twenty-five feet, but now the cultivators are coming to understand that sufficient space must be left between plants, or else, on account of the struggle for existence which goes on between the plants, the weaker are checked and hence they give less yield. Now the distance left between mango plants is not less than forty feet. The cultivators acknowledge that thus they give a better yield and the plants last longer. They generally finish their life-cycle in fifty to sixty years.

Many trees do not grow true to the parent if propagated from seeds. Thus the tree grown from the stone of the *Gopalbhog* mango seldom produces a *Gopalbhog*. Hence trees of special merit are produced by different methods of propagation such as inarching, layering, budding, grafting, since the trees are true to the scion or bud used.

The mode of propagation in the case of the mango almost always resorted to in Maldah is inarching.

Stones are sown at the time the fruit is in season and the plants raised from them are parted off into single pots, to be inarched upon the setting in of the rains in the second year after. At the close of the rains the union between the graft and the stock is complete and the plants are then separated and thoroughly established. The separation is done gradually, that is to say, the stock is not separated from the scion at once, but a little of the branch only is cut, then after three or four days a little more, and so on till the stock is wholly separated in about two weeks.

When inarching, by means of a scaffolding, a large number of seedlings are tied on to a single tree. All the pots are given water regularly ; but if the grafting is done in the rainy season no irrigation is required. The grafts are ready in about three or four months and are transplanted in the fields during the next monsoon. If irrigation facilities are available the cultivators graft at any time of the year,

still those grafted during the latter part of the rains when the heavy showers are over, they say, are better and more reliable. This is what *we should expect, as, it being the growing time, the sap flow is free.*

I saw here that some of the stocks were grafted high up, as high as five feet or even eight feet. These grafts they said were intended for places which are waterlogged. Such grafts are planted there .(*in* waterlogged places) and earth heaped up round them till the level of the soil is about six feet from the point of union.

The area of mango cultivation in the Maldah district is estimated *at about 50,000 acres, and the usual rent for such land is from three* to six rupees per acre.

The mangoes here, they say, suffer from a fungus disease. This *attacks especially old and jungle plants. The leaves from the top of a* middle aged tree begin to drop down soon after the rains are over and gradually the plant dies. This disease is contagious. Neighbouring plants are attacked and they undergo the same fate. Nothing however is known as to its cause.

In marketing the crop, those fruits that are not immediately disposed of are placed separately side by side on mango or other leaves *on a raised platform called a Mackan, and if this is done carefully* they keep for some time.

The profit of a good mango plantation is estimated on an average *at 300 to 600 rupees per acre.*

Dr. Erteja Husen, Post Kotwali, District Maldah, is experimenting on mangoes. In order to give the grafted plants good support he does as follows :—First of all, the place where the grafted plant should be is selected. There two stones of ordinary mango are sown in the fruiting season. A third stone is sown in a pot. On this is grafted (inarched) a good variety, when it is a year old. After it is established, the graft is placed between the two seedlings in the field and grafted afterwards with them. Hence it (the grafted seedling)* gets

* A & B.—Ordinary mango seedlings.

C.—Ordinary mango seedling already *once grafted on to a good variety and placed* here between ' A & B ' for being grafted *again with them to get more strength and* nourishment.

The two marks on A & B indicate the place where the seedlings will be cut off after the thorough establishment of the graft 'O'.

nourishment from three stocks. Similarly he is trying to import the flavour of camphor, rose etc. to the mangoes. For this he selects a three or four year old grafted mango plant, makes some incisions with a chisel, puts in camphor or any scent he wants to impart to the fruit and ties the spot with a cloth, watering it every day.

In preliminary cultivation, manuring, irrigation, grafting, pruning &c., the cultivators do not seem to bestow any particular attention on the mango plants and yet mangoes of the finest description are produced at Maldah; but to what circumstances the superior merit of the fruits raised is attributable, whether to any peculiarities in the soil or climate or to some particular mode of cultivation, it seems hardly possible to decide. When removed to other localities for cultivation, even under what would appear to be the most favourable conditions, the tree *produces fruits of somewhat inferior quality. There seems no doubt* that this is due to the presence, in the air, water or soil, of natural conditions favourable to the production of a speciality. We all know that this peculiarity in the excellence of fruits in favoured localities is neither confined to the mango nor to India, but is also found in connection with most fruits in all parts of the world.

A Note on Chikko* Cultivation.

BY

V. N. Gokhale.

DURING the last summer vacation I paid a visit to the Thana District which is so well-known for its garden cultivation. My first intention was specially to study and observe the methods there in use in the cultivation of plantains and mangoes. But in the course of my stay, I had the opportunity of seeing and going closely into a much more localised culture, namely that of the *chikko*, which will be found, I think, to have considerable interest. The *chikko* plant itself was a novelty to me. I had, of course, seen it here and there in private as well as in botanical gardens, but never as a regular organised production for the market. Obviously therefore, when I found the whole of some acres of land wholly cultivated with this fruit, my interest and curiosity was aroused.

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* *Achras Sapota.*

The plant itself is a somewhat curious one. It branches very thickly from the very bottom right to the top. The branches arise at right angles and are arranged in a circle thus giving the appearance of so many spokes of a wheel. They are long and tapering, crowded with leaves not much different from those of *shitaphal* or custard apple in shape or size. But the peculiarity is that the leaves also are found in whorls, forming clusters round the branches. They are always green and shining. The inflorescence of this plant is also very curious. In general appearance it resembles that of the *Bakul* tree, *Mimusops-Elengi* but the flower is not fragrant at all. It is also not a showy one as it is generally buried in a mass of leaves. The flowers also are always found in clusters and mostly they are axillary. The tree is slender and usually from ten to fifteen feet high. It grows very slowly, and spreads, for its height, over a considerable area.

As I have already observed, the inflorescence of this tree is axillary, and hence the fruits are to be found also in the axils. The fruit is very peculiar in appearance, if not in shape. It appears like a ball made of saw-dust. The raw fruit when pierced with a nail of a finger gives out a sticky white juice and when eaten in this condition though sweet it causes a choking sensation. When fully ripe it becomes darkish brown and the whiteness of the fleshy matter inside also undergoes a slight change. To the taste it is very sweet and delicious. The outer coat or testa is so thin that it can be easily eaten along with the flesh without affecting the taste. When the fruit is cut, it can be seen to be divided into ten to twelve parts or septas though no such trace is seen from the outside. In the centre of the fruit we find three long black albuminous seeds.

The plant is propagated in two ways. Firstly by means of seedlings and secondly by means of layerings. The plants obtained from the second method are stronger and healthier ; and, moreover much time is required to raise a plant by means of seedlings. The plant I saw growing very well in the red sandy soil along the sea shore. It can also be grown, as we know, in the black alluvial soil of the Deccan. But it seems probable that the red sandy soil and the sea breezes have much to do with the exceptionally successful growth of the plant.

When the plant is old enough to be removed from the pot a small pit two to three feet deep and a foot or two wide is made. Having been filled with the soil mixed with sheep dung manure, the tree is then planted in the hole. It requires watering every day till it is old enough when the water is given every third day. It is better to add manure every four or six months according to the quantity of manure

applied on each occasion. The pit is also dug up every time and the soil so kept light and porous. The pit is also made wider and wider every time so as to give greater space to the roots which grow almost horizontally. The biggest pit found was six feet in diameter. It is said above that sheep dung is applied as a manure but, beyond this, it is actually found that much benefit is derived from the application of fish manure.

The plant generally yields a bumper crop when it is five years old and keeps itself in full vigour till it is ten years old. Nearly a thousand big fruits are obtained from one single plant during the season which generally lasts from November to March. The fruit is as big as a small orange. In the rainy season we generally do not find fruits on the tree, though a few exceptions are met with. The fruit is in great demand in the Bombay market, and fetches a price from twelve annas to a rupee and a half per dozen. There are two varieties of plants, one yielding almost round fruits (as big as small oranges) and the other yielding egg-shaped fruits. The latter is valued much more than the former, the actual reason not being known.

In addition to the fruit eight to ten cuttings can be obtained every year from each plant. They are generally obtained from the bottom branches which spread almost on the ground. The cuttings also *bring a reasonable price. Each one can be sold for five to eight* rupees, thus giving in all fifty rupees on an average. Thus a plant from the time it is five years old (that is from the time it is fully grown) pays nearly a hundred rupees a year and that constantly until it is ten years old at least. This is the information given me by local cultivators.

We must at the same time consider what would happen when we have to make a big plantation. A square area of an acre can hold nearly *a hundred and fifty trees planted* at a distance of twenty feet, though fifteen feet is the distance that is generally kept. In the latter case, however, there is much crowding when the trees grow bigger. *In the early stages plantains can be planted between every two rows* of *chikko* plants so that wider planting does not result in serious loss. The plantain trees are cut down when the *chikko* plants grow old enough and when the latter appear to be obstructed by the growth of *the plantains.*

From the above facts it would seem that the cultivation of the *chikkos* is at least equally profitable with other garden plants such as mangoes, plantains &c., and is worthy of close attention both from those who are interested in the development of our Indian fruits, and from those who are seeking a profitable investment for their capital in suitable places in Western India.

Plantains Containing Seeds.

The Editor,

Agricultural College Magazine, Poona.

Dear Sir,

I read with great interest the article by Mr. G. B. Patwardhan on "A case of occurrence of seeds in cultivated plantains." He writes there that seeds are scarcely found in cultivated plantains but I have observed that there are many *seed varieties* of plantains under cultivation in Bengal. At least I found three such varieties in the Narayanganj market while on tour in Lower Bengal. The following varieties were obtained and examined:—

1. Zama kola (largest)
2. Tula pajh (medium in size)
3. Koburi (small comparatively)

Of these the last variety is the sweetest and is extensively grown. Seeds are found in all the above varieties. In Zama kola the seeds are harder, larger in size and are in great numbers. Six rows of seeds were quite distinct in the flesh. In the second variety the seeds are rather small and only five rows were distinct. In the third variety (kaburi) the seeds are small and few and were found scattered very irregularly in the edible portion.

Yours faithfully,

G. K. Kelkar,

Assistant Professor of Agriculture.

Veterinary Notes from Poona.

BY

F. Gracias, G. B. V. C.

I Traumatic Peri-and Endocarditis.

History:—An old debilitated buffalo cow was brought into this hospital for treatment by a poor cultivator of Poona, with a history that she was subject to attacks of tympany, which at times proved to be very severe. She was brought here pretty well blown; it was certain therefore that the history could be relied on. When questioned as to how long the animal was in this state, the answer invariably given was "for 2 or 3 days." How long has this disease been on her? "For about 2 months." Do you let her loose to graze very early? "No" Do you allow her to graze at all? "Yes." What times do you leave your animals? "All the people set their animals free at about eight o'clock in the morning; mine also go with them." Do you give her any grain feed? "Yes." What do you feed her on? "Cotton seed and bran." Do you feed her yourself "Yes." Do you examine the feed before it is given her? "Yes." Many other questions of a like nature were asked, but nothing definite could be got from the old farmer.

Symptoms and Treatment:—The animal was certainly blown but the distension was not of a nature to require immediate surgical interference. Therefore after evacuating the bowels and giving an enema, a drench consisting of oil, carminatives and stimulants was administered. The same drench without the oil was repeated in the evening and the next morning, when she looked decidedly better. The distension was considerably reduced and the dung and urine were normal. Her appetite had also returned by this time, but she was kept on low diet such as bran mash, and a limited quantity of hay was allowed her. By way of medicine an occasional stimulant dose was given her and tonics administered twice daily. For about seven days she seemed to be progressing favourably and was in fact getting into condition when suddenly, on the morning of the twelfth day, the animal was seen to be considerably blown, rumination suspended, food refused, muzzle quite hot and dry, and the animal seemed to be in excessive pain. Her head and neck were extended. The respiration and temperature were also

remarkably increased, the latter being 104°F. The pulse was also markedly changed.

On the evening of the eleventh day she had been to all appearances, well: in fact, were it not for the sudden change, to which she succumbed, I entertained full hopes of discharging her cured in a few days more. Towards evening of the twelfth day, she looked quite anxious, her pupils were dilated, and the head and neck more protruded. She seemed to be really suffocating; there could also be no doubt from the low groans emitted that she was in great pain. The extremities were now cold and the pulse more feeble and irregular. The irregularity of the pulse with coldness of the extremities, was, it *must be admitted, a suspicious symptom,* but not *sufficient for any one* to form a correct diagnosis of Peri and Endocarditis, although it is said to occur frequently in bovines and particularly in dairy cattle.

The writer has never had the good fortune of seeing more than one case and that while a student at the Bombay Veterinary College. He has great doubts still if he would be able to diagnose a similar case correctly. This has been a case of the utmost benefit to him however and he hopes he has learnt a good deal from it. He therefore trusts it may prove of interest to his professional brethren and those interested in cattle generally, who may not have had the good fortune, like the writer himself, of having treated a case of Traumatic Peri and Endocarditis.

After an ineffectual trial of carminative stimulant treatment, stimulant tonics with an occasional dose of a sedative mixture, were administered. Congees had also to be given her as she refrained from taking any food. On the thirteenth day, her midday temperature fell as low as 95. 6° F. *It was deemed necessary therefore to give her a subcutaneous* injection of strychnine which materially helped to prolong her life by a few hours. The temperature at 6p. m. was a shade better than at noon, but the other symptoms were the same, if not aggravated. The end was as could be seen, quite near, another injection of strychnine was given at about 8. 30 p. m. and the animal died at about 9 p. m. of the same evening.

POST MORTEM APPEARANCES :—As usual a post mortem examination was held on the carcase and as this was a case which remained undiagnosed and interesting to the very last, the autopsy was therefore very carefully made and its brief description may, it is hoped prove,

interesting. On ripping open the stomach the first thing noticed was a continuous escape of gas. The stomach was by no means cut accidentally that is certain; on close search the reticulum was found punctured: this of course explained the whole case at once. The thorax was next opened and it was found to contain a dark coloured fluid. The whole of the pericardium was highly inflamed and at the point of puncture it was very much thickened. The sac contained a little of this dark fluid but it was also mixed with a little pus. The pericardium was next removed and the foreign body, a needle. which measured about three inches long, all bent into different angles, was discovered in the muscular wall of the right ventricle, where a comparatively large cavity was formed, which contained a small amount of foul smelling pus. The endocardium appeared to be highly congested too and traces of thickening were found scattered about here and there.

II LACERATION OF THE ŒSOPHAGUS.

The subject is a roan country bred mare, standing about twelve hands high and about four and a half years old. She belongs to a poor cultivator of the village of Bhopuri, about five miles from Poona.

HISTORY:—This pony was let loose as usual in the morning among the other animals of the village. Two buffalo bulls, one of them a fierce ill-tempered brute, started a fight between themselves; the other a quiet creature, afraid of the wild beast, started running for its life. The former chased the latter some distance and finding this mare in its path, wreaked its vengeance by goring her about the middle of the neck, tearing the skin, muscles and the oesophagus, the trachea just escaping the bad gash.

The poor owner, quite flustered and worried, brought the animal to this hospital for treatment at about 8 p. m. of the same day.

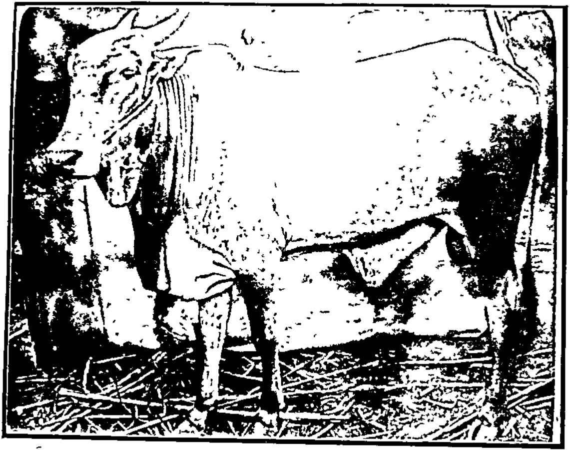
SYMPTOMS:—Nobody could mistake even at first sight the injury to the gullet. The chewed food could be noticed escaping from the open wound; besides a great deal of it was lodged inside the deep gash.

TREATMENT:—The animal was secured in the stock and its mouth kept open by means of a balling iron. A gum elastic catheter was then passed into the oesophagus as no horse probang was available. The wound was washed antiseptically and as the lacerations were extensive and deep, the skin wound was enlarged by about three inches. All loose tissues were removed and the wound rewashed. Unfortunately

however just about this time, the balling iron snapped, the catheter was consequently partially chewed by the animal before it could be removed. Owing to this mishap I had to cast her the following morning substituting a bullock mouthgag for the balling iron and using a fresh catheter.

The oesophagus was so much torn that had it not been for the escape of saliva and food, it would have been practically impossible for any one to recognise it. Suturing the torn lips was simply out of the question. The torn edges of the muscles were carefully sutured with catgut, and Iodine solution, of which I shall have to speak later on, was smeared all over the wound. The skin was then sutured with flax interrupted sutures. Cotton wool saturated in the above mentioned solution was placed on the wound, the neck bandaged, the animal allowed to rise, hand rubbed, walked about for a few minutes and her head secured in the stall. A bucketful of boiled water was next given her. She was given milk and thin wheat gruel which was continued for five days. On the sixth day the bandage was loosened and to the greatest surprise of us all, the external wound had apparently healed by first intention. The Iodine solution was repainted and the neck re-bandaged. She was now fed on a bucketful of rice congee twice daily and 10lbs. of lucerne. On the 7th day the pony unfortunately broke loose, tore off the bandage and scratched and mutilated the nearly healed wound. The muscular wound had by this time completely healed as neither food stuff nor saliva escaped from it. The external scratched surface was washed in the usual way and dressed with Iodine. The mare was given on the 10th day some hay and fine jowari stalk called in vernacular "Kurba" which she ate voraciously and with impunity. She was discharged cured on the twentieth day with the *advice not to feed hereon stout kurba for at least another fortnight.*

The writer, as will be noticed, has all along made use of Iodine solution only, in the treatment of his case. A fair trial was given it in the treatment of wounds, and he must say with pleasure too, that the success he has achieved within the last six months has been beyond his expectations. It is therefore his intention to place this simple recipe before his professional brethren in order to test for themselves its real value. The solution is made up of equal parts of Tr. Iodine, Spt. Rectified and distilled water. Fair sized tumours have been removed and treated with the same solution with the remarkable success in the following



A TYPICAL YOUNG BULL SUITABLE FOR BREEDING PURPOSES, AGE 13 MONTHS.

way :—The hair was either shaved or clipped quite short and the part washed with warm water and soap and dried. A clean incision was then made and the tumour carefully removed. Haemorrhage was arrested as usual and a thin coat of the solution painted inside the wound. The lips were then carefully sutured, the solution again applied and Collodion used to cover the wound. The case was then left alone for four or five days and the dressing reapplied. In from ten to fifteen days the patients were always found fit for discharge.

Cattle Breeding in the Karnatak and its Possible Improvement.

BY

R. S. Hiremath, L. Ag.

THE *Amritmahal* (Malla), the *Khillari*, and the *Krishnavalley* breeds and their mixed progeny form principally the cattle of the Karnatak. People make no scruples in mixing these breeds freely. Village cattle are left entirely to the course of nature without any control and without any of these artificial restrictions by which alone a breed can be saved from admixture, and usually from deterioration. Seldom is any selection made of breeding cows and bulls concerning their fitness for producing a strong and healthy off-spring. Any cow, however deformed or diminutive, is allowed to breed. Nor are inferior and imperfect bulls generally castrated in order to prevent them from acting as sires and perpetuating their shortcomings. The common practice of driving all the village cattle, male and female together, in one herd, leads to indiscriminate breeding. Most village cows are so small and of such little value that the owners do not think it worth their while to get superior bulls to serve them. These superior bulls are not very plentiful, and when available have to be paid for service, which payment the owner of the puny cow naturally grudges. In many instances, before the owner makes up his mind the village bull forestalls him. Such are some of the difficulties which lie in the way of village cows getting served by good bulls. Absence of such bulls is one of the prime causes of deterioration of the breed from generation to generation.

It has seemed to me during my travels in the last two or three years that it would be an excellent thing if two or more villages would

co-operate and subscribe for a special superior breeding bull suitable to the locality. It will then be a common property of the villages, and being allowed every license and tended by one and all would be in excellent condition. In certain populous localities special breeding bulls or he-buffaloes are kept home fed for breeding, a fee of a half to two rupees being charged on each cow served, higher fees being sometimes demanded. In many places no special breeding bulls are thus maintained.

In spite of what I have already said, and which appears to the vast majority of village cattle, there are in many parts a good number of cattle which are carefully kept and home fed. For these, which are possessed by many well-to-do cultivators, special superior breeding bulls should invariably be secured for service. Such herds are kept in open enclosures fenced with thorn, generally away from villages, and thus always graze away from the village cattle. They can thus be excluded from inferior village bulls which are not liable to mix with them. Such a herd should have its own special superior breeding bull sometimes selected in the same herd, but more often from some other herd to prevent in-and-in breeding. As the bull grows old and deficient in vigour, a young one should be similarly selected to take its place. As the young one is likely to act as a teaser, it should not be brought into the herd till the former one is sufficiently unfit. All the malformed and puny bulls should either be castrated or separated from the general herd of cows. Early castration does not do any harm as proved on the Poona Farm. They are still useful for work and their flesh is improved. They become more docile and manageable than the non-castrated ones.

Mixing a limited number of cheap village cows with a pure bred bull is one way of forming new and improved herds among villages, but this may take ten to twenty years to raise the standard of the progeny to the larger size and value of the pure bred animals, even if it is then done. It is said that generally the progeny second in descent attains much of the quality of the sires of the pure breed, or even if the traces of maternal defects should linger in it, an animal third in descent, almost certainly, attains almost that standard of size, shape, colour and efficiency. A transformation, therefore, from the puny village to any other good breed, if it is wished, may in this manner be completed, for most practical purposes, by one good bull purchased by

the public in common. The following table may illustrate what is asserted :—

A good Karnatak cow + pure Mudla bull = half Mudla progeny first in descent.

Then, half Mudla cow + pure Mudla bull = three fourth Mudla progeny second in descent.

Then, three fourth Mudla cow + pure Mudla bull = seven eighth Mudla progeny third in descent.

By going on in this manner a cow or bull very closely similar to the pure bred sire, may be brought into existence after the lapse of a few years.

In breeding, the villagers never aim at developing in the young one any particular aptitude or special fitness for draught, for fast trotting, for carrying loads, or for milking. They breed at random and wait upon nature, never thinking of assisting her in the least. They rarely endeavour in breeding their cattle to produce animals of large size, strong and shapely built, comely limbs and attractive colour which are valued highly in the market.

The following are considered good points in a breeding bull :—A long and stretching frame ; a good height ; a long and tapering head with broad and prominent forehead ; small but sound, clear and bright eyes ; small, active and erect ears ; thin and gracefully set horns, the difference between their thickness at the base and at the end being small ; neck of moderate length, full and muscular, and gradually tapering towards the head ; hump, small and well-shaped ; dewlap, thin and short ; full, broad and spacious chest ; well-formed strong shoulders and hind quarters ; strong and well-rounded ribs ; level back and broad loins with narrow flanks ; croup, level, whip-like tail ; anus, well projecting so that the dung may fall clear of the body ; sheath with little or no pendulous growth ; legs of medium length and well proportioned, having strong and fairly thick bones, and concording in movement and not turning sideways or brushing against each other ; fetlocks, short ; and hoofs, hard and small with equal halves, having a very narrow cleft between ; skin, horns, muzzle and hoofs black ; hair grey ; body compact ; teeth and testicles sound ; the animal, of good temper and free from hereditary diseases.

The above points have reference to beauty, strength and endurance. Though it is difficult to find out an animal having all the above menti-

oned points, still attention should be paid in choosing an animal having a majority of these good points. As "the bull is half the herd" his defects are much more serious than those of the cow, because of the number of animals of which he can be the father.

By this I do not mean that no special care or attention should be paid in the selection of a cow. The main points to be looked for in cows are a good size and length, shapely head and horns, broad hips and loins, large and well-developed breeding organs, a nice colour and a good temper. In the case of dairy cows, besides the above mentioned points particular attention shall have to be paid to the udder, teats and milk veins. The udder should not be very pendant but should be capacious, wide from side to side and extending well forward and backward and well-filled between the teats.

Teats should be handy, of good size, regular, squarely placed and wide apart. The milk vein should be of large calibre, tortuous and much ramified.

In the case of draught animals, thick short, and strong neck, broad chest and loins, short and bony legs, well-formed but massive shoulders and hind quarters, have to be taken into account in addition to the general observations. In animals intended for fast trotting, the requirements are different and to a certain extent quite the reverse of those fitted for heavy draught. A long and comparatively thin neck, long and thick legs with small fetlocks, and chest rather deep than wide, shall have to be observed. In the case of pack-animals, a strong chest and loins, a level and wide back with strong vertebræ and well-arched ribs, short straight and stout legs with short fetlocks, and well-developed shoulders and thighs, have to be considered. So in the selection of animals for breeding the most important thing that has to be borne in mind is the purpose for which the animals are intended.

One great evil which is very common in the Karnatak is premature breeding among the young stock. Calving by young heifers entails upon them serious after-consequences. The bodily development of the animal receives a sudden check and a diminished size is the result. The arrested growth of the bones makes the animals weak and lean. They seldom regain their condition and are reduced for life to a lower standard of strength and efficiency. The calf suffers even more than the cow. Ill-nourished before birth, the calf is likely to remain half

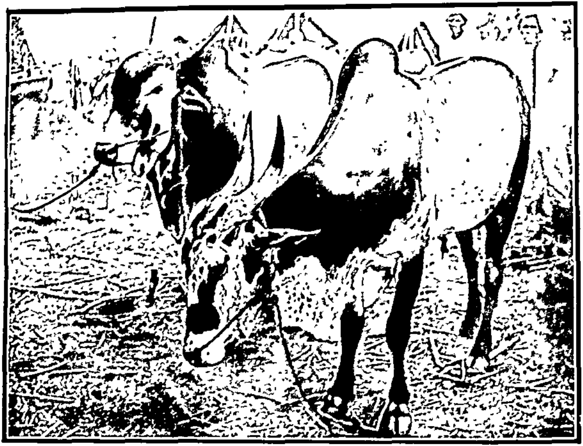
starved upon the mother's insufficient milk. The immaturity of the bull affects the vigour of the calf likewise. Thus, as the result of ill-assorted and injurious coupling of immature animals, stunted cattle come into existence.

Looking to our climatic conditions the season of breeding cattle stands prominent to receive due attention. There are three different periods in which cows are mostly found to come in season, (1) April and May when the early showers fall, (2) October, November, and December when the pasture is at its best, (3) January, February and March when cattle get fed on the refuse of the threshing floors (yards). The first period is not advantageous as the time of calving in the case of cows so conceiving happens to coincide with the following hot season, when the cow and calf are likely to suffer from scanty pasture. The second period is the season when cattle get into a condition propitious for breeding having had time to recover from the depressing effects of the previous summer by revelling in pasture which is then in its most abundant and vigorous growth. Impregnation at this period has the advantage of good season while the cow is in calf. The calving time will also fall in the early part of the succeeding rainy season. The third period is not an advantageous one as the dry weather follows immediately after conception.

In connection with the subject of breeding, there are certain facts which are very highly valued by experienced people and hence deserve to be mentioned here. These are (1) the age of the first conception of different cows, and (2) the intervals which they pass in calving afterwards. Some cows take bulls before they cut two teeth, others at two and some others later. This is rather attributed to the family to which they belong. These families are classed as (1) those calving annually (वर्ष गाई), (2) those calving biennially, (3) those calving triennially. In the last two cases the intervals are sometimes narrowed more or less within a limit of six months. Cows of the first class take bulls at about two teeth (one and a half to two years), of the second class at about four teeth (two and a half to three years), and of the third class at about six teeth (three and a half to four years), provided no exceptional circumstances, as a season of drought, influence and alter the natural conditions. The most prevalent class is that of cows calving annually. In making selection, experienced purchasers invariably prefer triennials, if they find them, and are willing to pay higher prices for them. Both

the calf and cow of this class are bigger, better made and stronger than the other two, and the biennials are better than the annuals. The reason of this is obvious. The milking periods of these classes of cows also vary, those calving at longer intervals continuing in milk also longer. Making allowance for good or bad keeping and individual peculiarities, annuals continue in milk from four to six months, biennials from twelve to sixteen months and triennials from twenty one to twenty seven months. Calves of the latter two classes are nourished longer upon the mother's milk and grow better. The long period of rest after calving especially after *they run dry, enables them to regain their strength and vigour lost at* each pregnancy. Annual cows, which usually suckle their calves from three to six months, are sometimes liable to a double drain, by the calf at the foot and the developing fœtus in the womb leaving no time to repair the loss. Thus in breeding, the selection of the family is of utmost importance in order to get strong animals.

The age of the bulls cannot be passed over. *At two teeth* (one and a half to two years), they are active and vigorous but much less capable of impregnating ; at four teeth (two and a half to three years) they are better fitted for fecundating but are thin and weak. Both these are too young to breed satisfactorily. They will not only suffer constitutionally themselves but also produce a weak progeny. From six teeth (three and a half to four years) up to the age of about twelve they are of established vigour and breed successfully without suffering from constitutional disorders, and their progeny is also strong and of good size. From about the age of thirteen they begin to decline, and the breeding powers altogether cease at about sixteen.



A typical pair of Mysore bullocks, age $3\frac{1}{2}$ years.—Price Rs. 475.

The Supply of Working Cattle.

BY

K. M. Pawar, B. Ag.

Head-Master, Vernacular Agricultural School, Poona.

Old and experienced cultivators believe and put forward the opinion that the decline in the productivity of the soil is due to want of good working cattle, and irregularity of rain. In olden times it is said that each farmer had at least two cows of his own which were maintained partly on grazing and partly on the fodder raised on his farm. Thus almost all of them were able to produce their own working cattle and therefore no want was felt. And looking to the previous records of cattle it seems that it has some truth in these statements. Want of cattle means faulty tillage. Heavy out-turns are harvested by proper tillage and by giving a proper amount of manure. And this requires a good supply of cattle. For cattle form the chief factor in Indian Agriculture, because all the power used on the farm is the bullock power and hence comes the necessity of increasing and keeping the cattle in good condition. In other countries machinery has largely taken the place of animal power and hence the question of increasing the working cattle is not of so much importance as is the case in India.

But times have changed here in India and the want of cattle is very much felt. The question has become so serious that it has become necessary to ascertain the cause of the decrease and take steps to remedy it. For, looking to the experience and remarks of old cultivators, it is clearly seen that the relation between the highest success in farming and the growing of livestock is so close as to be inseparable. It appears, in fact, that the measure of the success obtained is proportionate to the extent to which livestock is kept and to their quality. It follows therefore that every legitimate encouragement should be given to the livestock industry and that every legitimate effort should be made to deepen the farmers' interest in livestock production. Make it clear to the farmer that maintaining livestock on his farm will increase his profits and promote in many ways his best interests and in ninety-nine cases out of a hundred he will give, at least, some attention to it.

Before looking to the question of taking measures let us see what are the existing conditions, the present breeding centres and the purpose

for which the cattle are bred. The chief breeding places in India are the Gir Hills in Gujarath, the Satpura Hills on the border of West Khandesh, and some places here and there in other parts of the Presidency. The chief requirements for breeding are good grazing and an ample supply of good water. The places must be on a high level and have a considerable amount of shade. These are the natural requirements. From this point of view the Gir Hills are better off than any other place for they grow better grass and have excellent climatic conditions. On the other hand the Satpura Hills are excessively hot in summer, which tells upon the cattle badly.

The breeds are different in each place. The chief breeds are:—

Gujarath.—The *Kankreji*, the *Gir*, otherwise called *Surti*, and the trotting animals which are small in size and used round about Surat.

Satpura Hills.—The *Khillari* and the *Malvi*. These Khillaries differ from those called by the same name and existing in the Satara district. They are comparatively light and swift animals.

Other breeds known in the Bombay Presidency are the *Hanoum* and the *Deccani*. The *Hanoum* breed is bred round about Sangli and is small in size.

All of these breeds are used for farm work and generally no distinction is made between a good trotting and a good working animal. If we look to the breeders here we shall find them without any definite view as to the special purpose for which they are breeding.

Looking towards Gujarath, the Ahmedabad and Kaira districts are well suited for cattle breeding, fodder crops and grazing being usually plentiful. Except in extraordinary times as in the last famine period, and when no cattle from other districts intrude there, forage is abundant. In nearly all villages a few professional breeders *Rabaris* and *Bharwads* are to be found Bullocks for agricultural purposes are reared by the farmers from the time they are a few months old. At this age they are purchased, after castration from the *Rabaris*, many of whom go to Palanpur and Radhanpur States where the best *Kankreji* cattle are to be found and buy them. *Khillaries* or *Charans* are the names of the professional breeders in the Satpura Hills.

The breeders as a rule do nothing except producing the cattle. In Gujarath breeders keep up the size of the animal and keep up the type

pure as far as possible. But they do not look to the question whether the animal will be useful for work, milk, or trotting, and if the breeder has any object it is to try and accumulate all the desired qualities namely of milk, work and trotting in the same breed. And hence in attaining all we lose a good deal we might obtain in the capacity for working. As for instance if we want an animal for work it must be heavy and well developed in the hind quarters, of a good stature, and of a docile temperament. While if we want it for trotting it must be light and alert. This means that the presence of one shows the absence of the other and in wishing to combine these together there is a tendency to lose both. Hence the first important point is that we must have a definite view before us. While attempting to increase the number we must also pay attention to the quality of the animal we desire, that is we must see whether the animal is the best type for working purposes or not, in order that we may have an animal possessing all the best qualities for work. Our aim must not be only to increase the number but also the quality. The importance of having purity in the bull is very important. But it is beyond the scope of this small paper and so casual reference only is made to the subject.

In this aspect however the first and most important matter is the step of selecting a good and pure bull for a breeding herd. Each village should be supplied with a good and pure bull. Then continued selection in the herd should take place, and the heifer which proves below the mark should be weeded out. Thus we must develop a good herd to begin with and then increase the number. It is of no use, in my opinion, to introduce new breeds. The breeds, which we have, are suitable for their own places. If we introduce the *Kankreji* bullock of Gujarath in the Deccan, it being a delicate animal, will suffer, because the tract is a famine-stricken tract and has not good grazing facilities such as are found in its home, and so on. The Deccan breed, being hardy, on the other hand, is suitable. We must try to improve each of these by selection in its own tract and by using a pure bull.

In order to keep up the purity of a herd we must not allow any other bull in that herd and at the same time no young bull of the same herd should be allowed to remain in the herd. It is a serious mistake to allow young bull to cover the cows. For their progeny is sure to be inferior and unhealthy. Hence comes the necessity of early castration. There are many advantages of this but most important are :—

1. The heifer will not be covered by a young bull.

2. The calf will be well developed in the hind quarters, which is essential for good working cattle.

3. The young bull itself can work for a longer time without becoming tired.

4. The bullock is mild and docile.

5. The working capacity of the castrated animal increases.

These are the preliminary steps to secure good quality in the stock. But it is useless to have good stock unless proper provision is made for maintaining them, and here the question of feeding comes in. Feeding stuffs are of two sorts. One consists of bulky fodders or "roughages,"—the other is composed of concentrated foods. It is impossible to maintain animals on the latter only. For it will be too costly and the animal will not be satisfied with the quantity of the food supplied. The construction of the system of cattle demands bulky as well as rich food, and so the necessity of "roughages" is felt.

Under "roughages" are included all kinds of bulky fodders used for cattle. Whence to produce these? The chief reservoirs of all fodders are forests, waste lands, and the straw of good producing crops. It is clear then that we have to depend on them principally, though not entirely. Now the forests and waste lands being Government property we must leave them aside for the present. Because we do not get access to them very easily and therefore we have to depend on the other resource namely crops which give us fodder. Thus the question of growing such crops as will supply the farmer with sufficient food and fodder becomes of the greatest importance. No doubt in growing such crops only the farmer may draw a smaller income in the beginning but after feeding his fodder to the livestock he will get the same profit as with other crops and at the same time will maintain the fertility of his land by using the droppings of the livestock. If a farmer keeps at least two-thirds of his estate under fodder yielding staples there will be a large supply of fodder and I do not think that then there will be any necessity to look further for its supply. Each man must have a store of fodder which will last at least for one year. It is generally believed that a farmer can easily maintain a cow and a pair of bullocks on the land worked by one pair of bullocks on the fodder grown on it. At this rate each man will be able to produce bullocks sufficient for his own use. The chief thing is to show the farmer the importance of

growing and storing fodder sufficient for his own use and he must have at least one year's store in reserve.

This being done the question of pastures comes in. For it is necessary to have some pastures on which the cattle may graze. In grazing, they get exercise which is a factor in keeping the cattle healthy. It will be no good to feed cattle always on raised fodder alone. Because it will be expensive and the cattle will not get sufficient exercise. People therefore may be induced to keep some lands under good grass for their own cattle. They must be induced to grow and maintain good grass with proper care of it. They should be asked to give the same attention and care which they give to crops. Thus I think there will be sufficient supply of fodder for each farmer.

After making a supply we must see that it is used carefully. If we see to the dunghills we shall find much of the fodder wasted and is allowed to rot or otherwise burnt. This shows that feeding is not properly attended to. The animal must be given sufficient fodder at regular intervals. The greatest care must be taken in feeding animals. For the development of the animal depends on the proper care and feeding. The fodder given to cattle must be good and wholesome and at the same time must be given in sufficient quantity. It must be well cut if coarse and long, to avoid wastage. The same supply if used in this way will last for a longer period. Many of the coarse grasses and straws of crops are wasted only because the cattle do not relish them. But if they are properly treated I think much of it can be utilised. The *kadbi* should be cut to pieces and straw of cereals trampled under the feet. These may be sprinkled over with salt and *gul* water at the time of storing and I am sure the cattle will then eat them, and thus much of the wastage will be stopped.

The second thing which attracts the attention of a minute observer is the fact that the farm produce is usually sold at a very cheap rate. Many inferior kinds of grains are produced on a farm, and, moreover, at times much good grain is inevitably damaged by rain etc. and such produce is sold cheap in the market. Instead of thus selling, it would often be more profitable to use these inferior materials for feeding the animals with advantage. These will be good nutrients to be fed with rough and coarse fodder.

Many farmers are in the habit of selling their fodder. If the places are at a distance from a market it is sold cheap and when

brought to the market cartage becomes very costly. And it is also a troublesome task to dispose of such bulky things. It will be better if these bulky things are turned in to small ones and then disposed off. That is if they are fed to cattle and the produce from them if sold will be often far more profitable.

Proper attention must be given to the feeding of growing calves. The feeding of calves at present is unsatisfactory. For care of the calf is taken only for the first year when the cow is in milk. If the cow is not a milking one then the calf is left to nature after the first year, it is left to itself until the end of the second or third year when it is again fed with some care. The calves being left to themselves do not grow to their full development since they do not get proper feed. The care of growing calves is of prime importance and as long as this is not done I think no better results can be expected. But greater attention to the calf, is in my opinion, one of the most important means of increasing the number and quality of working bullocks. Many of the calves die simply because no proper care is taken of them when young and growing.

Then, we come to the necessity of giving good and pure water to the cattle. Generally we see cattle drinking water from stagnant and noxious pools especially in villages depending on well water. If water from such reservoirs be given, the cattle is liable to get many of the most serious diseases from which cattle suffer in the Bombay Presidency. Severe losses are incurred at times from such waters but the farmers are usually quite ignorant of the cause.

Medical advice must be at hand. It is found necessary now-a-days since cattle are dying from many contagious diseases. The farmer does not know the cause of these and when cattle die suddenly or in large numbers the people suspect poisoning. But many cases will be found attacked by RINDERPEST or some other contagious disease and no proper assistance is available. Hence the necessity of medical assistance is much felt. Formerly it is said that almost all villages had some expert hands who would detect the cause of death. But those who had some special knowledge of any subject tried to hide it and kept it secret. That being the case, all knowledge of the matter has died with them. They used to treat almost all cases by using or applying the juice of some plants. At present also some such men are found

here and there, but they are very few and hence veterinary assistance is necessary. When such assistance is available it will be easy to show the people the necessity of isolating the cattle affected by contagious diseases. For serious losses are recorded chiefly through want of knowledge. Many cattle are affected by foot and mouth diseases (common everywhere) and the attack spreads only because the affected cattle are allowed to mix freely.

All this is not enough if the cattle do not receive somebody's personal attention. There must be somebody to give special attention to them. In its absence all is useless.

Famines are great destroyers of cattle. The remedy (suggested above) of keeping at least one year's fodder in reserve is the best remedy to avoid to some extent the wholesale losses from famine, but it involves, as will be seen, a certain amount of capital lying idle, as an insurance. The other drainage of the cattle is the slaughter house. We have no special breeds for beef purposes as in other countries and hence the work cattle are used for slaughter. Hence some arrangement is badly wanted to prevent good, healthy, useful and young cattle being slaughtered. For this associations are seriously needed which would look to this question. And they must be assisted by the rich ; for at times they may require money to buy cattle to avoid its falling into the hands of the agents of the butchers.

Such are in my opinion the two chief things limiting and hindering a proper increase in the number of cattle, when combined with the poverty, apathy and ignorance of the people in many of our tracts. I will conclude by a suggestion which demands larger capital and larger interest on the part of business men rather than of cultivators. This is that some companies may be formed in order to breed animals for work. No doubt this is a costly and risky business. But in the end it will surely succeed and will be a paying concern, if well managed. In most other business there is a difficulty in disposing of the produce ; in this there is none, for there is a large, keen, and increasing demand for well grown and useful animals. It is necessary, however, that such companies should have their own lands for growing fodder, and also as pasture. The men in charge must have a liking for this business, must have a thorough knowledge of breeding. Then and then alone it will be a paying business. There are already a number of rich associations

already in existence which are formed for the preservation of cattle. It is possible that these might be induced to go in for the improvement and multiplication of stock as well as its preservation, and if so they would probably furnish an object lesson which purely business companies would not be slow to follow.

The Shirhatti Cattle Fair.

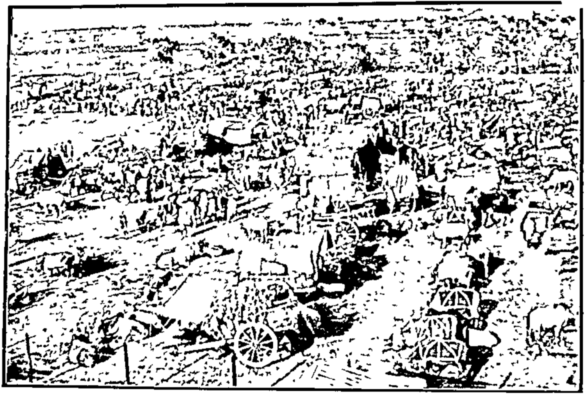
BY

M. L. Kulkarni,

Divisional Inspector of Agriculture, Southern Division.

IN the Southern Maratha Country there are a number of places where cattle fairs are held annually. Shirhatti is one of the most important of these fairs. It is a taluka town of the Sangli state and is situated to the south about twenty miles from Gadag or about twenty-one miles to the north-east of Gudgeri railway station. From both the railway stations there are macadamized roads. The fair is held in the month of May which is the most suitable time for cultivators to attend, the fair being free after the harvest of *Rabi jowar* and other crops, and also after the picking of cotton. It is also a time when cultivators have plenty of money in their hands as a result of the disposal of their cotton crop. Thus a number of buyers of cattle go to the fair and a large number of cattle are sold in the course of three to four days. The fair is held in memory of a Lingayat swami who was a great saint. A big convent (मठ) is built after his name in the middle of which there is a square *pakka* built *samadhi* (समाधि) of the swami which is the place where the visiting pilgrims worship. The pilgrims consist of all classes of people *viz.* Lingayats, Brahmins, Marathas and Mahomedans. But the majority of people are Lingayats.

Cattle of various ages, from young calves of one year old to big work-cattle of advanced age of various breeds are brought for sale in the fair, the majority of the cattle being, however, of the Mysore breed. The original breeders in the Mysore province bring a number of young calves from one or two years old to the Mailar and Kurvatti cattle fairs in the Ranebennur taluka. These are bought by local cultivators and are carefully reared for one or two years more, and then sold in the



General view of the Shirahatti cattle fair.

Shirahatti fair. Certain cultivators in the Ranebennur and Haveri talukas make it a profession to buy young calves from Mysore at a cheap price, feed them for a year or two and then sell them at the exorbitant rates of Rs. 300 to 500 per pair. An excellent pair of bullocks is sometimes sold up to Rs. 700/-

A large number of cattle to the extent of about three thousand were brought in the present year to the fair for sale. About three quarters of the number were *Amrit Mahal* cattle and the *rest* were local breeds. A few 'Krishna valley' and 'Khilari' cattle from the Jath State were also brought for sale. There were only four Amrit Mahal cows in the whole of the fair. Mysore breeders never sell their cows or heifers. They sell only the young bull-calves. A good bull-calf of about a year old is sold at from Rs. 100 to Rs. 125.

The number of cattle (three thousand) present for sale at Shirahatti is said to be only half of the number of last year. The fair thus seems to be a very large one and it deserves some sort of encouragement from the Sangli state. The Sangli state does not at present levy any tax on the cattle brought for sale as is done at Chinchli nor does it take any trouble to keep any record of the number of cattle which come for sale, or the variations in prices year by year. It would be very useful information if all this were noted down, as well as the various places from which they are brought and the ages of cattle with their prices. This information although of little value now would be of great use after some time, in order to indicate how far cattle breeding or rearing of young calves is developing in the Shirahatti taluka or in its neighbourhood. However the Agricultural Association of Shirahatti which is patronised by the Sangli state intends to organise a systematic awarding of prizes for the best animals in the show whether they are bred in the Sangli state or outside and also intends to keep a record of the exact number of animals sold. The idea is excellent if properly organised and continued permanently.

Some people think that the prizes awarded at the Shirahatti and similar shows go to outside people, that is to say to the Mysore breeders as the majority of good cattle come for sale in these fairs from that state and consequently they expect contribution from the Mysore state. The idea seems to be quite narrow. As we are now-a-days depending more and more on Mysore cattle it is our duty to encourage the breeding of these cattle whether the breeders belong to the Mysore state or are our own people.

Experiments in Lac Inoculation.

BY

T. R. Kotwal, B. A., LL. B.,

Sub-Judge, Poona District.

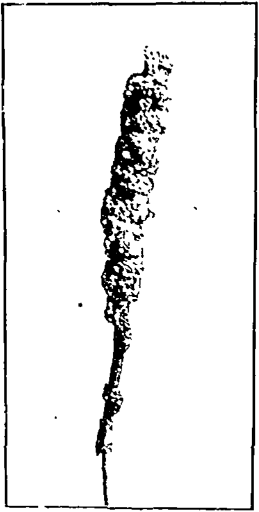
(The following account of experiments which were made by Mr. Kotwal at Saswad will be of very considerable interest under the present conditions when the cultivation of lac as a bye-industry is being extensively recommended.—Eds.)

THE difficulties with which I have had to contend in my experiments in lac inoculation are very considerable, as I have to move every alternate month between Saswad and Talegaon and hence I have not been able to watch my experiment continuously. Some of the trees inoculated were not my own and were used without any previous pruning. There were three heavy showers of rain soon after the inoculation in October 1910 with stormy weather and great lightning. There was the severe cold weather in the end of January and beginning of February and much wind from that time to the end of May. The experiment may be said to have been carried on under natural conditions and those too very unfavourable. The following trees were inoculated :—

In my own compound an *Umber* (*Ficus glomerata*) tree on two branches. One branch has small specks of lac about the size of a pie in several places scattered on parts of the branch. The other branch is fully covered with lac similar to the sample sent herewith from a *Babul* (*Acacia arabica*) tree. (*Vide* illustration). The length covered is about 2½ to 3 feet.

Many insects crawled up the branches of the *Bholar* (*Cordia Myxa*) tree but were washed away and those left did not survive long. The branches were fine new juicy sprouts.

The branches of *Shitaphal* (*Anona Squamosa*) trees were inoculated. The insects spread very rapidly and settled on several branches. The branches were then very leafy in October 1910. Now the old leaves have fallen off, new ones are coming out, the branches are bare and the lac can clearly be seen. On three or four branches there are small in-



Lac grown on *Babul* twig
(*natural size.*)
BY MR. F. P. KOTWAL.

innumerable specks of about the size of a small pea. On other branches the lac is thickly spread something like the sample sent. (*Vide* illustration). The trees used had numerous branches fit for inoculation and trees were not higher than six or seven feet. They seem to thrive well in parts of this taluka. From what we can now see, it would appear that with proper care and attention the trees may be fit for cultivating lac equally with *Bor* (*Zizyphus jujuba*), *Palas* (*Butea frondosa*), and *Kusumb* (*Schleichera trijuga*). It is worth while making trials. These trees thrive in Bassein in the Thana District, and the Superintendent in charge of the gardens at that place may perhaps test and amplify my experience and show practical results. The insects on *Karatha* (*Feronia Elephantum*) tree were all washed away. The insects on *Pangara* (*Erythrina*) were also washed away. The bark of *Bhokar*, *Pangara*, and *Karatha* is smooth and differs from that of *Shitaphal*, *Umber*, *Bor*, and *Babul*.

One *Bor* tree was inoculated and the insects have formed fair incrustations around some branches. Boys disturbed the branches a great deal being attracted by the berries. This tree was not a failure.

Two *Babul* trees were inoculated. The sample is sent from one tree. The other has fared fairly. These trees are in the compound. There was no disturbance.

I did not see the trees from February till the end of May. I believe this experiment to be a success so far as a layman and a beginner with no previous training, theoretical or practical, except his own reading and experiments can modestly say.

Three *Pimpal* (*Ficus religiosa*) trees were inoculated. The branches of two showed good signs that the insects had spread and had begun to form incrustations. They are still to be seen on the branches. Probably the severe cold affected these insects. Two trees were by the river side, and one in the heart of the town. Working under the most unfavourable circumstances I conclude that *Babul*, *Umber*, *Shitaphal*, and *Bor* trees inspire hopes and looking to the initial cost and trouble the experiment may be continued under trained supervision.

I got the mother lac free of charge from Pusa in October 1910 at Dasara time. The rates charged to the public are moderate. I got the sticks tied to the trees under my supervision through my peons and the trees have throughout remained open to inspection to all who desired it.

My experiments at Talegaon were enough to inspire me with hope to repeat the same at Saswad. I have done these things more for recreation than for profit. My experiments were confined to two dozen sticks and it would be presumptuous on my part to claim too much for them.

Saving of rice seed in the Konkan.

BY

G. K. Kelkar,

Assistant Professor of Agriculture.

THE Konkan tract includes the districts of Kanara, Ratnagiri, Kolaba, and Thana and extends all along the sea-coast. It is bounded on the South by the South Kanara District of the Madras Presidency and on the North by the Pardi taluka of the Surat District. This tract is mostly hilly—covered with forest growth—the rainfall being heavy, sufficient and assured. Two kinds of rocks are found here-in the Southern Konkan laterite is the principal rock and the soil formed from it is poor but well drained. In the Northern Konkan the prevailing rock is trap and the soil found is of superior quality.

On account of climatic conditions rice forms the most important crop of the Konkan—it being the staple food grain of the people.

The following represents the average under rice in the 4 districts named above :—

Kanara	184,502
Ratnagiri	71,852
Kolaba	251,507
Thana	318,107
	825,968 acres.

As pointed out above the soil in the Southern Konkan is inferior in fertility and the out-turn of rice obtained per acre is low by comparison with that in the North Konkan. On account of this poor out-turn the rice eating population of the South, principally depends on the Northern districts for at least a part of the year. At least, I know this is

the case in Ratnagiri. When the North Konkan is unable to meet the demand Rangoon rice (Halwa) comes in and makes up the deficiency. When this is the case, every effort should be made to find out some means by which the rice crop can be improved. There are many ways in which this can be brought about. One of these is the saving of seed, which is required in very large quantities in the case of the crop under discussion.

This article is intended to give an account of an attempt in this direction.

While I was on leave at Ratnagiri I heard that a gentleman Mr. *Balkrishna Wasudeo Joshi*, Banker, was trying some experiments in connection with the saving of seed. His village named Dhamanse (धामणसे) is situated about eight miles from Ratnagiri.

Mr. Joshi is very enterprising, industrious and painstaking. It will not be out of place if I mention in brief the practices of agriculture he is following. He has planted cocoanuts, Areca nuts, plantains, limes, figs, oranges, knol-khol, cabbage, chillies, bringals, guinea grass &c. in a small garden round about his house. He preserves his farm yard manure, ashes, and last scrapings from the byres in separate pits. Recently he has taken up to the preservation of urine by putting earth under the feet of the cattle.

During the last three years he is working at the problem of finding out whether any saving of seed can be effected in sowing seed in the seedbed of rice and so far as the results go, they appear to be very successful and encouraging. The details of his methods are given below.

Before the commencement of the experiments Mr. Joshi used to sow four maunds and fourteen *pailis* of paddy on a seedbed of thirty-five and a half gunthas and the seedlings raised on such a bed were enough to transplant two acres and twenty-eight gunthas of land Now he sows only four and a half pailis of seed on a seedbed of only sixteen and a half gunthas and is able to obtain sufficient seedlings to plant the same area as by his old method. Most of the cereals tiller freely when they are given plenty of room. I have counted up to eighty tillers produced by planting one seed of wheat. Mr. Joshi's thin method of seeding encourages free tillering and thus supplies him with plenty of seedlings.

Mr. Joshi's preparation of the seedbed consists in ploughing the area and making it very fine before spreading the *rab*. In his method there is no saving of *rab* materials. He spreads the same quantity of material which he used to spread on thirty-five and half gunthas, on the smaller area viz. 16½ gunthas. When the material is sufficiently dry, he covers it by a layer of coarse grass and then spreads a uniform layer of small clods of earth, not bigger in size than an ordinary areca nut, to a depth of about an inch On account of thick layer of the *rab* material as well as of earth, the whole thing burns slowly as if smother-burnt. He believes more in the addition of the ashes and heating of added layer of earth than the heating of the surface soil.

After burning the ashes are immediately ploughed in. The seed is sown in a dry seedbed (*Dalwaph*) at the rate of twenty to twenty-five seeds per square foot and then mixed with the soil. The seedlings are ready for transplantation within twenty-five to forty days from the date of germination. The early varieties take twenty-five days and the late varieties thirty to forty days. The seedlings begin to tiller within a fortnight and the tillers vary from two to eighteen per plant. The seedlings tiller freely and grow vigorously on account of more air, manure and large feeding area for the roots.

When the seedlings are transplanted into the main area, the tillers are separated and planted three to four in each place. On a medium soil nine inches distance is allowed between two seedlings each way and one foot on a better soil. At the time of planting each planter is supplied with a measured stick for use at the time of transplanting. The seedlings tiller further in the main area and produce spikes which vary from twenty to thirty-six per bunch. During the last two years Mr. Joshi followed the method only during the rains, but during the year 1910-11 he raised his seedlings of *Vaigana* rice (the hot weather crop) and transplanted precisely in the same way giving nine inches distance between bunches of seedlings.

I had the benefit of seeing this crop in the month of February last while still standing. I found the whole area very systematically planted and the crop was uniformly growing. This system of planting at regular distances is a little more expensive than the ordinary one in vogue, but it seems to pay in the end.

It would be seen from the results arrived at by Mr. Joshi, at Dhamanse, that though there is no saving of *rab* materials in any way,

the whole quantity being utilised on about half the area, still much less land will be required to be attended to for the seed bed and there will be an enormous amount of saving in seed.

He saves four maunds and nine and a half *pailis* of seed in cultivating an area of two acres and twenty eight gunthas and this seed alone is sufficient for one man's feed for four months. This means a great saving when the whole area under rice is taken into consideration.

The area under rice reported above is 825,968 acres. If we deduct half of this (412,984 acres) as light land where conditions for impounding water are unfavourable and the broad-casting method must be followed, it leaves 412, 984 acres, where the transplanting method *is necessarily followed. A very large amount of seed saving can be* effected from the above area.

Taking four maunds and nine and a half *pailis* as the amount of seed saved for every two acres and twenty-eight gunthas as a basis, the amount of seed that can be saved in the Konkan tract alone amounts to 35130 *Khandis*. This is obviously an extraordinary saving.

Although the method of planting few seedlings in a bunch is of recent introduction in our Konkan tract, still we find the Bengal and Madras Agricultural Departments are experimenting with single seedlings for the last five or six years. It has been proved on the Samalkot Government Farm (Madras) that by planting a few seedlings only six pounds of seed is enough per acre instead of seventy pounds as ordinarily used by the cultivators. The instructive results obtained at the Cuttack (Bengal) agricultural station and reported during the year 1908-09 are given below :—

Treatment.	Outturn per acre in maunds (80 lbs.)							
	1905.		1906.		1907.		1908.	
	Grain	straw.	Grain	straw.	Grain	straw.	Grain	straw.
	mds.	mds.	mds.	mds.	mds.	mds.	mds.	mds.
1 Seedlings per hole.	25⅞	36	19	22½	26½	50	34¼	60¼
2 Seedlings do.	23¾	34¾	18	23¼	26	55	37½	61½
4 do. do.	22¼	31½	17	23½	25¾	65¾	36	67¾
8 do. do.	22	36¾	16½	26	25¼	72½	36¾	60

The results of four years show that one seedling per hole gives an outturn equal to two, four or eight seedlings per hole; hence there is no need to transplant more than one seedling per hole.

Mr. Joshi has one great advantage in having an ample supply of stream water at his command. He can let in water in the field when required and stop when not needed. But such situations are numerous in the Konkan. Only experimenters and workers are needed. Mr. Joshi's experience is only of two or three years' standing and his results may be taken with a certain degree of caution, still there can be no doubt that the method adopted by him, if generally successful, will greatly contribute towards sowing of paddy seed. If the leading landlords, who cultivate their lands themselves, take up this problem and work it up seriously, it will be of immense benefit to the cultivators of the Konkan.

Wire-Netting as a Protection Against Crabs in Rice Seedbeds.

BY

K. V. Joshi, B. Ag.

IN the Konkan and the Maval tracts of the Deccan where rice is the chief crop, the land crab is known to everyone, on account of the damage it does to the rice seedlings.

Losses from crabs are far greater in the Maval tracts than in the Konkan. The reason for this is not known but it may be due to the colder climate of the latter tract. The damage is done to the seedbed and not to transplanted rice, the reason of which is explained further along in this note. Crabs also damage the *bandhs* of the rice fields by boring holes in them, and the cultivator is often thereby put to trouble and has to incur considerable expenses in repairing them, so that they will hold water standing in his fields.

The crab which does the damage referred to is a small animal generally of the size of a small rat with a hard shell covering almost all parts of its body. It has several pairs of legs, but the most characteristic feature of the animal is the presence of the large pincers which give the crab its peculiar appearance. It walks sideways instead of

straight. These crabs always live in underground burrows which they dig themselves. These may be either straight down, zig-zag, or curved with two openings. The burrows are generally excavated on the bandhs of rice-fields or the banks of streams and *nalas*.

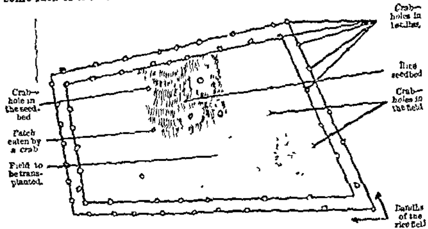
The *food of the crabs is green and dry grass*, and also, any organic matter to be found in the soil. It is a timid animal and runs away and hides itself at the approach of a man. The pincers above referred to are its only organs of defence.

There are three kinds of crabs. 1 *Mathya* or *Pandhra*, 2 *Khelad* and 3 *Chingli*. The first two only are injurious to the rice fields while the third lives in villages and jungles. It is always black in colour.

Crabs are eaten by the cultivators of the Maval tracts and the Konkan and are said to be very nourishing. The third kind namely the *Chingli* is the species which is preferred for food. After the transplanting of rice is over the cultivators have very little field-work and so they often go out to catch crabs; sometimes they go at night with torches in their hands, to the banks of rivers and streams where they find crabs in large numbers.

The tail or posterior end of a crab is bent under its lower surface and tightly held against the body. This forms a cavity in which in case of the female the eggs are laid. After hatching the young remain in this cavity till the first rains in June when they issue forth to forage for themselves. Each mother crab sends forth from one hundred to one hundred and fifty young about the size of a large spider. From this time onwards throughout the rainy season the crab lives more above the ground than in his burrows, spending his time in search of food. The rice is sown at the first rain and grows much within a few days. The wild grass does not start as early as the rice seedlings, which are therefore the only grass food that the crabs see on coming out of their holes. So they attack the rice seedlings and do a great damage by eating them. They feed mostly at night. At this season some of the crabs leave the *bandhs* and make their holes in the seedbed proper, so that they get food near by on coming out of their holes. They cut the seedling at its base and take away the whole seedling. A view of the seedbed about three to four weeks after sowing will show patches of

different sizes eaten by the crab. The following diagram may give some idea of the condition of a field in the Maval tract at this stage.



The crab does not do much damage to the transplanted rice because at that time it gets young green elsewhere, and the stems of rice are not in the soft and succulent stage which it prefers.

By the end of the monsoon the crabs close their holes by bringing earth from below. I have observed that the earth which they bring up from below is always wet which shows that as the moisture goes lower and lower they deepen their holes farther and further thus always keeping themselves in a moist place. The depth of a crab-hole varies from one to four feet or more.

The remedy practised by the cultivator is to pour a solution of cowdung in water into the hole of the crab. After three to four minutes the crab emerges from his hole probably on account of the strong and nasty smell of the cowdung. He is caught and killed. Some add to this solution *Karanj* leaves cut into small pieces which makes the smell still worse. The wife and children of the cultivators spend considerable time in killing crabs by this method, while the cultivator himself is engaged in ploughing his fields. Crab-killing by this method goes on for about a month.

But this is not a certain remedy against the crab. The crab may come out provided it is in the hole into which the cowdung solution is poured, but often no crab appears. In cases where the holes are very deep the quantity of the solution required is very large. Moreover there are thousands of holes in one field especially on the *bandhs* from which they walk to the seedlings by night and hide themselves by day. Hence the number of crabs to be watched and killed is enormous, and

so under these circumstances the cultivator has to sow a much larger seedbed than would otherwise be necessary, knowing that a part of it will be eaten up by the crabs. This means that more *rab* material to burn in preparing the seedbed will be required.

The nuisance from the crab has been a great hindrance in the experimental work of which I have been in charge, in connection with investigations into the value of *rab* and its substitutes at Lonavla. Ammonia liquor was used instead of cowdung solution during one season but the same difficulties as with cowdung were experienced. Moreover in using the ammonia liquor it is necessary to walk in the seedbed which at times damages the young seedling. Further, as the experiments were in a measure concerned with the value of manures, it was not wise as a rule to add a powerful manurial agent like ammonia.

So in the year 1909, it was suggested that a fencing of wire-netting should be put round the experimental plots, the object being to prevent the crabs outside the fencing from going in and thus leave only a limited number who are to be destroyed inside. This object was largely fulfilled as the bigger crabs could not go through the fencing since the holes of the netting were smaller than their bodies, nor could they climb up. But those smaller than the holes of the netting could easily go through.

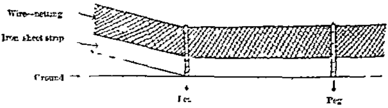
Therefore, in the following year, a further step was taken against them and a strip of thin iron sheet was fixed round the fencing allowing a little of it to be buried under ground. The breadth of this iron sheet-strip was six inches. Thus the egress or ingress of the small crabs was prevented. There only remained the killing of the crabs which were already within the *bandhs* of the plots proper. A regular campaign was made against them last year, after the rice was transplanted, by means of the cowdung solution system, and a large number—small and big as many as five thousand—were killed. Of course the number still left inside was also large and could not be calculated. The young ones had already hatched out and they were not killed to any great extent.

As a result of the treatment, however, the damage was reduced to half what it was in the previous year, and if the campaign be continued for three to four years, the protected area, I think, will be free from crabs. In our experimental plots there are four *bandhs* to each plot and so the number of bandhs inside the protected area is large which enables the crabs to hide themselves and escape capture. But if in a big field a fencing of wire-netting is made with no *bandh* inside, the area could be freed from the crabs much more quickly.

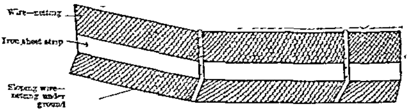
The method of putting in the wire-netting is as follows :—

First a sloping ditch nine inches deep and one foot broad is made round the seedbed area which is to be fenced with a wire-netting. The wooden pegs about two feet long (about as large as tent pegs) are fixed at every fourth foot all round, putting about a foot in the soil and leaving a foot above. Then wire-netting which is generally three feet broad is cut into two pieces of each of a width of eighteen inches, and is put on the slope of the the ditch six or seven inches deep, the slope always being towards the outside. It is then covered over with earth. The remaining one foot of the wire-netting is fixed to the pegs all round by means of staples, three to a peg. A thin iron sheet strip six inches broad is now fixed outside this fencing, putting an inch or two inside the earth and leaving four to five inches above. This is also fixed to the pegs by nails These strips can be cut out of galvanised iron sheets, of the usual size (eight feet by three feet) in which dimensions they are sold in the bazars. The following figures will give some idea of the fencing.

I VIEW ABOVE GROUND.



II VIEW BELOW GROUND.



The cost of putting this kind of wire-netting fencing to a rice seedbed sufficient for transplanting one acre may be calculated as follows :—

The area of seedbed should be approximately six *gunthas i. e.* it will occupy an area one hundred and twenty feet by fifty-four feet so,

that the length of the wire-netting and as well of the iron-sheet strip required is 350 ft. each.*

	Rs. a. p.
Cost of 350 ft. of wire-netting 1½ feet broad at Rs. 18-0-0 per bundle of 350 ft. by three feet (to be cut in the middle)	9 0 0
Cost of 350 ft. of iron sheet strip 6 inches broad at Rs. 3-0-0 per sheet of eight feet by three feet *i. e.* 7·3 sheets at Rs. 3	21 14 5
Cost of 88 pegs at two annas per dozen ...	0 14 8
Cost of staples and nails.	0 15 0
Wages for carpenter and one man for two days at 0-8-0 and 0-4-0 respectively.	1 8 0
Total Rs.	34-4-1

Thus the cost of fencing a seedbed sufficient for an acre comes to Rs. 34-4-1 which should last ten years or more. Taking ten years as its average duration, the proportionate expenditure for one year comes to Rs. 3-6-10. Now in the present practice the cultivator is required to sow a bigger area for the crabs. The loss in seedlings due to crabs may be calculated from ten to fifteen per cent. of the seedbed, depending on the locality.

The cost of raising seedlings sufficient for one acre by burning *branches for rab (six gunthas seedbed) comes to Rs. 14-4-0. (Cost* of cultivation Rs. 2-2-0 per *guntha*, cost of seed four annas per *guntha*).

Supposing that 15% is the damage to the seedlings, its cost comes to Rs. 2-2-3. Thus in putting the fencing he is required to spend one rupee four annas more. Besides he will have to invest the sum at one time. The advantage of the fencing will be that he will not have to keep his wife and children in the field in the rains after the crabs except for the first two or three years. Thus their labour will be saved for the rest of the seven years.

Each year the material for *rab* becomes increasingly difficult to obtain and so the cost of the *rab* process increasing. The cost of this fencing of wire-netting will soon come to be of financial advantage, but

* The length of the wire-netting could be considerably reduced if the seedbed were made more square than this. The same area would be included if a square bed, eighty one feet on each side were used, and then only 324 feet of wire-netting would be needed. (Eds.)

it does not seem to me advisable to introduce it generally in the present conditions.

It may be noted here also that nine crabs' holes bored obliquely in a curved manner with two openings were found made by the crabs from outside to inside below the wire-netting, in a length of two thousand one hundred feet of fencing. This the crab is likely to do in course of time but it can be checked by a comparatively small amount of observation over these holes.

In the present year an area sixty feet by ninety feet was fenced with wire-netting for the seedbed for growing various varieties of rice under experiment and as there was no *bandh* inside the fencing there was very little damage done to the varieties—in fact none. It is observed that if a *bandh* between two fields is removed and the two fields are made into one, the crabs leave the locality and shelter in the side *bandhs* of the same field. So if there be no *bandhs* inside the fencing there will be no good shelter for the crabs and so they can be got rid of in two years.

How to Study Botany.

BY

W. Burns, B. Sc. (Edin).

IN ancient fables we read of enchanters who by a wave of their wand could raise tempests, level hills, and strike men dumb; but more marvellous than these old tales, and astoundingly real, is the transformation effected on the face of India year by year at the coming of the rains. Here in the Deccan during April and May the barren hillsides lie scorched and yellow. The roads are intolerably hot and dusty, and the days long and weary. Thunderstorms and occasional downpours herald the Rains. At last they come, rolling up the valleys in irresistible cloud battalions, bursting in streaming torrents on the mountain tops, and descending to the thirsty plains in mists and drifting showers. A few days of this and lo! what a change. A great wave of greenness seems to have swept over the land. No longer is the hillside bleak or the desert barren. The delicate verdure of new grass and springing herb has hidden the waste places. Life comes with a rush. You shall see the wild plantain on the Ghats opening leaf after leaf as the water soaks to its parched roots and

reawakens the sleeping life. Even stones become green with algae, and the wave of vegetation threatens to enter our very houses.

It is indeed a time to raise songs in a poet and prayers in a devotee. To the student of science it is an irresistible call to seek after Nature's secrets and pry into the springs of life.

Many students have felt this call, lived for it, died for it, and left us as their legacy the vast and varied science of Botany. *How shall we follow in their footsteps, enter into the mysteries of life, and add something to that fair science?*

We are students. Some first year, some second, some third, some (let us say) n^{th} year, but all students and we hope to be students till the end. What have we in common in the study of this science and what methods are specially suited to each stage of our advancement? Let us think over these matters a little.

It seems to me we have in common the need to have our eyes opened first to the wonder of the living world around us and second to our own powers of understanding and controlling that world. Plants we have seen since we were born. They have become common to us and we need to be shown that nothing living is common. Then we need to be shown that in us are the intellect and the energy to seek out the secrets of the life of these plants and to turn our knowledge to the benefit of the race. As students of an Agricultural College we must never forget this latter point. Our knowledge is for the improving of man's material conditions.

Again, we all need guidance in our studies and a supply of botanical wisdom from those who have worked before us. Here come in the parts played by teachers and books. Good teachers and good reference books prevent the student from wasting time in fruitless labour and futile experiment, but they do not and cannot take the place of the student's own questioning of nature. The teacher helps the student to begin his studies, assists him over some difficulties and shows him likely points of attack, but the student who relies on his teacher for his actual knowledge is no student but a parasite. The student must win his knowledge for himself. Now, how is this to be done? Obviously by direct observation of and experiment on plants. In a curriculum so limited as ours it is apparent that this cannot be carried to the fullest extent, and recourse must be had to books to verify and amplify facts personally gained. Books may be of real use to the busy student if critically read and analysed so that the information thus won is lodged

systematically in his brain along with and completing the knowledge gained at first hand.

Now as regards the various stages of our progress. The business of a first year student is to attempt to see as much as he can of plant life and understand as much as he can of the way plants grow, feed, reproduce, and of how their bodies are constructed and adapted. Accurate knowledge of as many plants as possible is the aim. When asked, for example, to tell what he knows concerning the function and structure of leaves his mind should immediately go back to this and that plant that he has seen, he should conjure up the place where he saw these plants and the questions he asked himself about their leaves. To this he should add the well-digested facts got from experiments shown him or made by himself, and should complete his idea by well-weighed statements from reliable authors. His knowledge is thus compact and complete so far as it goes. In applying his knowledge he should endeavour to see how the operations of practical farming arise out of and are connected with plant physiology.

The second year man in this College should continue on the lines just laid down, but should give more attention to the comparison of plant structures especially of flowers, and should endeavour always to see how a plant is related to its surroundings. There is large scope here for the man who is keen to know new plants and these can always be named for him in the Herbarium of the College. He should devote special attention to accurate dissection of plants of agricultural importance and should not rest content until he knows his few natural orders thoroughly–not only as regards their distinguishing characters but also as regards their distribution, polliuation, mechanisms, relative systematic position and so on.

The third year man should devote himself to a close study of the few cryptogamic types in the syllabus with a view to finding and grasping the unity of structure and function which shows us that all plants are derived from one source. The study of plant diseases needs careful microscopic laboratory work and a quick eye in the field. Especially the conditions favouring or disfavouring diseases should be noted. Plant Breeding is a difficult subject but if the facts of variation are represented to the mind by known and actually seen cases then the basis is sure. The main thing is to get practical examples of all the phenomena of variation, crossing, correlation &c., otherwise knowledge is indefinite and useless.

In this College it is not possible in the three years to go very deep into the study of Botany, but a third year man ought to be so trained and disciplined (mainly by himself) as an observer, an experimentalist, a reader and a logical thinker that he will be able and eager to push on to new productive work in this or any other science.

Some Agricultural Proverbs of Gujarat

BY

B. S. Patel.

THE study of the common current proverbs of a district or a people is a very fascinating one. In the present article, I am going to try and describe some of those most common in Gujarat, and as the Magazine is of a technical character I propose to limit myself to those which are in most frequent use in connection with agriculture. A great deal of traditional wisdom is contained in many of them, and hence, it is possible that they may furnish an insight into the actual experiences of the Gujarat farmers, who are, as is well-known, considered probably as capable, as industrious, and as successful as any in India. In the explanation and translation which I can give, it is inevitable that some of their charm and force will be lost, but, in spite of this, some idea of their meaning will be retained.

In the first place, let us consider the names and dates of the *Nakshatras*, or divisions of the season on which the conduct of most agricultural operations is based.

The lunar year is divided into twenty-seven *nakshatras*, which form the bases of religious, commercial and agricultural operations. Each *nakshatra* contains thirteen to fifteen days. The *nakshatra* being a much shorter period than a month admits of closer attention and a closer relationship to agricultural operations.

The names of the *nakshatras* and the dates for *Samvat* 1967, 1910-11 A. D. are as under :—

6th November to 18th November 1910. — *Vishakha.*
19th November to 1st December 1910. — *Anuradha.*
2nd December to 14th December 1910. — *Jyestha.*
15th December to 27th December 1910. — *Mul.*
28th December to 9th January 1911. — *Purvashadha.*
10th January to 22nd January 1911. — *Uttarashadha.*

23rd January to 4th February 1911.	— *Shravan.*
5th February to 17th February 1911.	— *Dhanishtha.*
18th February to 2nd March 1911.	— *Shatatara.*
3rd March to 16th March 1911.	— *Purwabhadrapada.*
17th March to 29th March 1911.	— *Uttarabhadrapada.*
30th March to 12th April 1911.	— *Reoti.*
13th April to 26th April 1911.	— *Ashwani.*
27th April to 9th May 1911.	— *Bharani.*
10th May to 23rd May 1911.	— *Kritika.*
24th May to 6th June 1911.	— *Rohini.*
7th June to 20th June 1911.	— *Mrigshara.*
21st June to 4th July 1911.	— *Ardra.*
5th July to 18th July 1911.	— *Punarwasu.*
19th July to 1st August 1911.	— *Pushya.*
2nd August to 15th August 1911.	— *Ashalesha.*
16th August to 29th August 1911.	— *Magha.*
30th August to 12th September 1911.	— *Purwa phalguni.*
13th September to 26th September 1911.	— *Uttara phalguni.*
27th September to 9th October 1911.	— *Hasta.*
10th October to 22nd October 1911.	— *Chitra.*
23rd October to 5th November 1911.	— *Swanti.*

On this basis I will give a number of proverbs in common use.

1. Proverbs Relating to Rain.

If there is no rain in *Rohini* there can be no sufficient fodder for bullocks.

If there is lightning in *Rohini* and no rain there will be very little harvest.

If there is intense heat in *Rohini* and high winds in *Mrigashar* there will be heavy rain in *Ardra.*

Magha knows no medium either no rain or rain in heavy showers.

If there be rain or lightning on the fifth of the first half of the month of *Ashadha,* be sure of good monsoon and keep only bullocks and seeds.

Rain in *Ashwani* foretells a scarcity of corn, rain in *Reoti* foretells a very poor monsoon and rain in *Bharani* foretells absence of grass even if it does not rain in *Kritika.*

A sheaf of *Pushya* sowing will produce as much as an armful of *Ashalesha,* a head load of *Magha* and the entire field of *Purwa* sowing, fit only for fodder.

If it rains in *Ardra* the whole year will be prosperous.

The rains of *Magha* will produce abundance.

If it does not rain in the month of *Shravana* so much corn will be produced as to enable the farmer to fill his granary.

Rain in *Pushya* is very beneficial to the crops.

If it rains in *Hasta* all sorts of grains will be produced.

If it rains in *Uttara phalguni* so much grain will be produced that the dogs even will refuse to eat of it.

It is better to have heavy rains or no rain in *Rohini* than to have a little rain.

Rain in *Ashalesha* is so injurious to the crop as to be of no value.

If it rains *Purwa* the farmers will be filled with grief.

Rain in *Swanti* is so injurious to cotton as to leave the cotton cleaner's bow quite ideal.

The rain in *Chitra* is so heavy as to flood the rivers and so strong as to throw down even standing walls.

It is generally showery in the month of *Shrawana*, it rains heavily in the month of *Bhadrapada* while very little rain falls in the month of *Aso*.

2. Miscellaneous.

Culture, manure and water are the things required to produce a full crop.

The farmer will gain in proportion to his care in cultivation.

Ploughing is absolutely necessary for the field to yield a full crop.

If a farmer is tired of his work he will get nothing from his field.

Protection of the field crop depends upon the maintenance of the hedge.

As we sow so we reap.

Thundering clouds give little rain.

No amount of artificial water can compete with rain-water.

Rain at an unsuitable time is of no use.

If a man wants to carry on agriculture, he must have a cart and a pair of bullocks.

Plantain bears fruits once in life and a mango-tree does it often.

Whether a field is workable or not can be judged only on the field.

Sow the crop according to condition of the field.

If a farmer does not attend the field operations himself, he will be the loser.

Usar lands give no corn.

Agriculture and the drama require many men for their prosperity.

Loss made by missing opportunities in agricultural operations can never be repaired.

A cow is more paying to a farmer than a horse.

Jowar is often attacked by insects but never *gurar*.

The quality of fruit depends upon the quality of seed sown.

One should buy a milch buffalo after milking, and a bullock after yoking him to a cart.

A germ of the smut disease even in hundred maunds of *Jowar* seeds will spoil the crop.

Many are dependent upon a farmer for their livelihood but he on none.

Our Konkan Staple Crop.

BY

M. N. Padwekar, B. Ag.

IN the whole of the Bombay Presidency, there are four main staple crops *viz.*, Rice, Wheat, Bajri and Jowari, commonly used by all the people in varying proportions. In the Konkan all these almost entirely disappear and the sole grain crop would be rice, were it not for the fact that certain inferior millets as *Nagli*, or *Nachani*, *Varai*, *Sawa*, are grown on the poorer lands and eaten by the poorer classes.

As rice is the chief,—almost the only,—grain crop, the people of the Konkan almost entirely depend on it. It is generally considered that rice eaters, as a class are energetic and persevering, if not very strong,—and this is certainly well illustrated in the character of the people of the Konkan. As already stated the people almost entirely depend on it. Almost all the preparations of eatables begin from rice, and are too numerous to mention here. A short note on such a crop culled largely from my own observations, may be, it is hoped, of some use.

It is hardly necessary to mention that rice is essentially a crop of wet regions, growing in tracts where the rainfall average is above fifty inches per annum or in places where the soil is marshy or capable of holding a good deal of moisture. It grows on soils of almost any description provided it gets a good supply of rain or irrigation. In the

Konkan rice is grown, in greater proportion, on low lying soils which in some cases produce two crops—*kharif* and *rabi* rice. There are some varieties of rice which grow even on salt lands. In fact rice can be grown on any soil, even on soils with the depth of few inches. The only soils which are not used for rice cultivation are those on the hilly and sloping land which are used for producing the inferior millets such as *Nagli*, *Varai* etc. The inferior millets form the food of the poor for a few months, after which period they pack off to Bombay and get employment in the Bombay mills. The men are usually careful to return home by the end of the hot season to work on their land, and grow another crop.

In the Konkan, the main or rather almost the only method of rice cultivation is that of transplanting at any rate so far as the *kharif* crop is concerned. Except in salt or in marshy lands *kharif* crops are grown by transplantation. *In the case of rabi paddy the method varies.*

In the case of the *kharif* crop what is generally done is to select a high lying plot in proportion to the extent of the field available as a seedbed. Generally the seedlings in a plot measuring about four or five gunthas* are more than sufficient to transplant one acre. The selected plot then receives a layer of cowdung wet or dry but generally dry in the Ratnagiri district, about one inch thick. It is however a prevailing custom in the Thana district to use wet cowdung, dry or decaying cowdung being costly and rare. This cowdung layer is spread in December or April according to the nature of the soil. Early producing soils known in vernacular as *Halvi* soils get the layer in December. It then receives another layer of bundles of shrubs or loppings of trees above it, the thickness of the layer varying from half an inch to one inch. The bundles or loppings are technically known as "*kawal*." The cutting operation begins in December or thereabouts and ends with January as later on the leaves etc., are lost. Loppings of *Ain*, *Kinjal*, *Nana*, *Bonda* and *Saya* and such other forest trees are selected. If these loppings be not available, some of the shrubs such as *Dhawati*, *Ukshi* etc., are cut and used as well. *Mahan* and *Garwi* soils are green with a standing crop in January and hence the operations we have commenced to describe are in these cases postponed till the crop is harvested in March, and the soils are then treated in April or May till which period the *kawal* is dried and preserved for such soils. The *kawal* so reserved is naturally inferior as much of the contents are lost owing to heat and dryness. A few days after this layer of *kawal* is spread, it receives an additional layer of grass or *kawal*. The grass

* A guntha is equal to one-fortieth of an acre.

spread on the roofs of houses instead of tiles in the monsoons and removed in the middle of winter to guard the houses from being set on fire, is generally employed All these layers are about nine inches thick in all. Now only one thing remains and it is to sprinkle decayed earth or dirt from the vicinity of the house. If this be not sufficient, soil from some other place is obtained powdered and then kept aside for being sprinkled over the layers. The object of using this soil is two fold. The first and main object is to regulate the burning of the layers and the secondary one is to add bulk to the mass spread on the soil. The soil so reserved is thrown over the layers by means of a *sup*—an implement used in winnowing. This operation is performed when the layer is wet owing to dew or in the absence of dew, some water or water mixed with cowdung if possible is sprinkled over the heap before throwing the soil so that the soil becomes wet and gets a firm setting. The whole mass spread in the field is then set on fire about the middle of the day. The natural advantage of setting fire to the layer at that time, is that the layer is heated owing to the bright sun and hence the fire easily and evenly spreads on all sides of its own accord. If the burning be too active and rapid some more earth is thrown which checks the fire and prevents the surrounding objects from any chance of being burnt. The intensity of the fire is due to the *Javal* and grass which burn out till the evening but the fire is not entirely extinct for some time after. If a portion of the layer still remains unburnt, it is again set on fire and completely burnt to ashes. The plot to be treated is never ploughed before this treatment. The process of burning the soil just described is called '*rab*.'

After a few showers of rain, when the soil is completely wet, the whole field except the rabbed plot is twice ploughed and levelled. The first ploughing is technically known as *Ulhal* and the second is known as *Ber*. After each ploughing the field is levelled. The method of ploughing is to begin at one corner of the field and turning at the other corner at right angles to proceed half way and there turning again at right angles to complete the parallelogram. The figure formed is a rectangle in which one side of the field forms one side of the rectangle half the other side forming the other side of the rectangle. The plough then goes on forming similar as well as equal rectangles close by the first figure until the whole field is completely ploughed. Another method is to plough the field forming so many ovals. The second ploughing begins crosswise so that the plot is completely ploughed.

Even before ploughing the field, they have to broadcast the seed on the rabbed piece of ground a few days before the regular showers begin,

this sowing being called *Dhulwaf* sowing. For sowing purposes, the cultivators invariably select pure, unmixed varieties. Such of the farmers as are well-to-do and as can afford, select a particular plot of the ground to get the seed paddy from, when the crop flowers or when the seed is formed. The selection is simply the result of appearance. On this side latrines are rarely found and hence the fields are well manured in particular places. The crop here gives a fine appearance and such spots are usually chosen to take seed. The selection can safely be said to be practical and hence trustworthy. The selected plot is harvested with care when it is nearly ripe but not fully ripe. At this stage the seed is bright and plump and has a good appearance. At this stage the seed paddy is known as *Kankadan Bhat*. It is then dried and the seed is separated from the head which is called *Lombi* or *Kesar*. The seed is then carefully stored up in a *Mudh* covering of rice straw neatly wound keeping the seed paddy in the centre. The seed is so preserved till the next year's sowing season with special care. The farmers will even perish with hunger rather than think of using the seed rice of so much importance to them. The seed rice is not sold by auction even in case of distraint by Government, it being considered as one of the necessary articles for a family. In the case of negligent farmers they buy the seed from some *Khot* or landlord who is careful to hoard up rice of any variety. These only take into consideration as a rule, two main divisions coarser and finer varieties. This stored rice of any variety becomes the seed rice and naturally none can expect a good crop when the seed is not pure and good. But calamities of this nature do not often occur as the relatives help a man by lending him a portion of the seed rice preserved by them. Here it must be mentioned that the cultivator will never take his seed rice from a number of persons except in cases when he desires to cultivate so many varieties. The seed is lent to him at double the ordinary price. Sometimes it so occurs that the cultivator has nothing to live on and cannot get any money from the *sawkar*, there being nothing but seed rice that he can mortgage. Under such extreme circumstances, the cultivator approaches the *Khot* or *sawkar* with the stored seed rice and requests a loan of him on this security, entreating him at the same time to take care of the stored seed and to lend the same to him at the time of sowing. The seed rice, in this case, is not sold but mortgaged. The debt paid is in kind and the rate of interest is 50 per cent. To illustrate the point—if a *sawkar* lends one maund to a farmer in June or July of 1908, he will get one maund and a half in November or December of the same year 1908. No one will pay or lend rice to a farmer who has nothing to mortgage or who

has not got his plot ploughed and sown. The amount and interest are paid in kind.

The seed obtained in this way is then broadcasted on the plot already treated with the *rab* process and the plot is ploughed about two inches deep with difficulty owing to the hardness of the soil. The seed is sown some eight days before the regular showers are expected. The seed germinates a day or two after a good rainfall. The seed required to obtain seedlings sufficient to transplant one acre varies from twenty-four to sixty-four pounds, on an average, about forty pounds.

With salt lands which are called *khari zamin,* the method differs. The soil cracks in winter and summer but in the rainy season it turns as soft as butter with mud which is more than three feet deep. A few typical varieties are grown in such a soil. The labour required in such a soil is not great. What preparation of the land they have to do is to turn over the clods in winter and summer with a peculiar implement about six feet long and resembling an English row. The implement is known as *Pendshi* in Marathi. Transplanting cannot be resorted to in such soils owing to the mud produced as there is some fear of being buried in it. The seed is broadcasted after it is artificially germinated when the regular season commences. The seed rice is poured in big circular metal vessels about four feet high with a diameter of about two to three feet. The vessel may be filled with water or water may be added afterwards. At any rate the seed paddy is well saturated with cold water till it germinates *i. e.,* for nearly two or three days. The germinated seed paddy is then taken out and carried over to the field where it is simply broadcasted.

(*To be continued*).

A method of treating the injury caused by the Spines of Hairy Caterpillars as practised in Assam.

BY

F. H. Ahmed.

THE spines or hairs of several of the hairy caterpillars are more or less poisonous. When they are stuck into the skin they cause irritation and inflammation of the parts affected, whose cure is not quite easy. When proper care and immediate steps are not taken to get rid of the hairs, the pain becomes more acute and the parts become a mass of continued inflammation. I had recently the occasion of witnessing three cases what were affected almost at the same time of the day. One of these was not treated at all, to the second, lotion of Potassium Permanganate was applied and the third was treated by the indiginous method.

The country method of treating such a case is as follows :—Place seven leaves of *Alocasia indica* one upon the other over the affected part, then over these a piece of stone sufficiently big and hot to cover and heat the part; hold the stone for some minutes till the heat is felt on the parts. This is enough to burn the hairs as is believed and it is found that from this time the inflammation, irritation, and pain begin to cease and in a day or two the part is cured.

In above cases the third method was found the most effective and took the least time to cure the injury, the second was not more successful than the first in which the injury was left without treatment. Afterwards the first and second cases were treated according to the country method but then took more time to cure.

It may be interesting to note that if a hairy caterpillar is placed in a leaf of *Alocasia indica* and the whole thing shaken together with slight jerks the hairs or spines of the caterpillar fall off and it seems as if it has moulted. The truth of this observation is quite easy to verify and can be done without any risk.

College News and Notes.

Our magazine starts with the present number a new year of its existence—a year in which we trust it will continue to increase in influence. Its care and management also, pass this year to new hands, the senior editor and manager having concluded their college career and bid adieu to their *alma mater*. In taking upon us the burden of this important trust,—a trust whereby we hope to bind faster the links that separate the past and present members of the College—it behoves us to take a retrospective glance at the career of our Magazine.

There is every reason for us to congratulate ourselves on the excellent reputation which the Magazine has obtained under the control of the late committee, which has put a great deal of honest and steady work into it. It has become a storehouse of much agricultural information of both great and small importance and a source of interest and study to the students as well as the general public. The wide circulation our Magazine commands in the Bombay Presidency is a convincing proof of this. We cannot but refer here in particular to the strenuous exertions of some of the members of the late committee whose active help and zeal, though it was a valuable asset to the College, we are deprived of this year. Messrs. H. K. Mehta, F. H. Ahmed, and S. R. Paranjpe were among the first and the hardest workers for the magazine. They tended it in its infancy and with fostering care helped it to wax strong. We regret these gentlemen have left us but we congratulate them all, Mr. Mehta for the bright prospects that have opened out to him in Bombay, and Messrs. Ahmed and Paranjpe for the successful close to their college career. We wish them all fortune's choicest blessings for the future, and have every confidence that they will not forget the ties that bind them to the Agricultural College, and that they will help by their contributions the upkeep of our magazine, as they laboured in its cause when members of the College.

The results of the University examinations though not equal to those of the previous year were still very creditable. It is unfortunate that there were a number of failures in the F. Ag. examination. But the average standard of success was maintained in the S. Ag. and B. Ag. examinations. Twenty students have launched forth as graduates, twenty six have scaled the step to the B. Ag. class and fourteen to the S. Ag. class. We offer our best wishes to Mr. Inamdar who stood first

Mr F. H. Ahmed. Mr S R Paranjpe.

The first Editor and Manager of the Poona Agricultural College Magazine.

in the F. Ag. class and has been awarded the Gulabdas Bhaidas Scholarship. Mr. Bhadkamkar of the B. Ag. class succeeds to the monitorship of the college hostel.

Of the special students, the first year men deported themselves well in the College examinations and so also those in the third year, all of whom have received the diploma in agriculture.

There is a large influx of students for the agricultural course this year. Among the new first year's class, which now numbers thirty eight, we have more Christians and Parsees than in the previous years. The short course class has fifteen men on its list—an advance on the number of the last year, which shows the growing popularity of the class and the eagerness of young men for education in agriculture.

We wish most heartily all the students a prosperous year and trust that we shall have the pleasure of recording brilliant successes at the end of the coming year.

We regret that, though the students of the S. Ag. and B. Ag. classes have taken up their farm-work with a will and are anxious to turn their plots to the best account, dame nature has not been pleased to smile graciously on them. The continuous rain at the beginning of June gave signs of a good monsoon, and the sowing operations were commenced as soon as there was a break. Unluckily however, the break has lasted already too long and is causing grave anxiety. The S. Ag. men are all working uniformly at cotton, and the poor germination of their crop shows the necessity of rain soon. We rely on Providence to help us to have a successful year in our farm operations.

The agricultural course of the degree year has been much changed and the direction of change is for it to become more and more practical. Accordingly the Professor of Agriculture hopes to give practical training in the new agricultural laboratory. This year the students will have their practical training under the directions of Mr. Horne, the expert manager of the Civil Dairy.

On Saturday the 24th June the B. Ag. Class visited the *Manjri* Farm. There was the demonstration of the test of various ploughs on

the removal of sugarcane stubble. The Director of Agriculture, Prof. Knight, Mr. Horne and Mr. A. A. Musto the Agricultural Engineer, and other members of the agricultural staff of the college were present on the occasion. The South-bend Chilled plough was found to be the best. The students returned in the afternoon having seen the working of the power sugarcane crusher there installed.

Very soon after the University examinations in March, Dr. Mann left for England to take a well-earned and much needed holiday. We were all very glad to have him again among us on the re-opening of the college term. We hope the change has greatly benefited him to enable him to take up his arduous duties. Prof. Burns acted as Principal, during Dr. Mann's absence.

We tender our sincere greetings to Mr. S. B. Butani, M. A. B. Sc., who has taken the place of Mr. Mehta as assistant Professor of Physics and Mathematics since May 15th. Mr. Butani who comes from the D. J. Sind college, Karachi, bears a very high reputation as a scientist, and we feel sure that his anxiety and concern for the students will win for him the esteem and love of them all. We wish him success in his duties.

The work of the foundation of the college hostel is now complete. Further operations will be resumed after the rains. It is expected that the new quarters will be ready and available next year.

The second block of the college buildings is nearing completion. In fact, the offices of the Professor of Agriculture and the Zoological laboratory have been transferred to the east wing of the block, and the lecture rooms are being utilised. The spacious hall which is a fine piece of architecture is being given the last finishing touches. The library has been shifted from the Chemistry block to its own proper place above the hall. The inauguration of the college by H. E. the Governor will take place towards the middle of July. Preparations are in steady progress to accord His Excellency a hearty reception and there is no doubt that the college grounds will wear a most pleasing appearance in a short time.

We offer our hearty congratulations to the students who have graduated this year and whose names we feel pleasure in recording below:—

BACHELORS IN AGRICULTURE.

Patel, Maganlal Laxmidas.	Abhyankar, Damodar Dhondo.
Lahiry, Kamini Kumar.	*Udhash, Dosabhai Pingalshi.*
Sane, Dhondo Ganesh.	Medadkar, Dattatraya Sadashiv.
Talukdar, Jamini Mohan.	Jarmalli, Narayan Balvant.
Patel, Bhailal Motibhai.	Datt, Sachindra Krishna.
Bagalkot, Govindrao Bhimrao.	Halkoti, Ramanagouda Yellappagouda.
Shukla, Chhotalal Kachra.	Kathavate, Vishnu Manohar.
Paranjpe, Sadashiv Ramchandra.	Ednani, Mangharam Nenumal.
Baluch, Ghulam Hyder M. B.	Vaishnav, Sadashankar Manishankar.
Shukla, Harisakharam Navnitram.	
Dharwadkar, Pandurang Govind.	

DIPLOMATES IN AGRICULTURE.

Ahmed, Fazl Haque.	Gupta, S. R.
Mazumdar, P. N.	Barakzai, Mahomed Usman F.
Manvikar, L. S.	

It is with the deepest feeling of sorrow that we record here the death of one of our past students—Mr. Pranshankar Jayashankar Bhatt, L. Ag., B. Sc., who died at Berlin on the 5th of May last. He joined the Agricultural and Science branches of the College of Science in 1902 and passed the final examinations of these courses in 1906. He stood first in all the three Agricultural examinations and passed in the second class at the B. Sc. His course was all along a very brilliant one. He was appointed Lecturer in Chemistry at the Agricultural College in April 1907. In July of the same year he received the Sir Mungaldas Nathubhai and the Bombay Government Scholarships to proceed to Cambridge where he was to study Agriculture and especially Agricultural chemistry. The climate of England did not agree with his health and he had to return to India. While in India he looked quite healthy and the best medical men advised him to go back. But as soon as he went there, he again became ill and so went to Berlin last year for change of climate. There he became so seriously ill that he could not be removed even to England. His friends knew that he was very ill, yet the news of his death was a great shock to them. He was so much loved and respected by his friends that the impression of sad feeling on their heart can never be wiped off even by time, but the sad feelings that must have overcome his parents and wife are beyond imagination. May he rest in peace.

College Gymkhana.

Since the last issue of our Magazine, the Gymkhana activities were in abeyance owing to the University examinations and the vacation which followed. On the reopening of the College on the 1st June, its usual spirit and animation returned with the return of the students all full of renewed vigour to work spiritedly in the field of agriculture and in the field of sport. All were eager to set the Gymkhana agoing, and as soon as convenient, on the 8th of June, a general meeting of the staff and students was held to elect and entrust the year's business of the Gymkhana to a new committee. The election is a very representative one and we trust will be fruitful of great good, particularly in the fostering of love for sport and in the spread of fellow-feeling among all the members of the College. In wishing the new committee all success in its onerous work, we feel it our duty to offer our best thanks to the retiring committee. We thank specially Mr. D. L. Sahasrabuddhe who for two years in succession as Chairman of the Gymkhana—a department which is as much the essence of a College, as the scholarly erudition which the College aims to infuse in its students—did all he could to preserve an even tenor in all matters pertaining to it. Many a delicate question is liable to crop up in a Gymkhana which unless delicately handled may disturb its progress. We are glad that the coolness and general disposition of Mr. Sahasrabuddhe paved a smooth course for the successful working of the Gymkhana, and we have no doubt that Mr. S. L. Ajrekar who succeeds him will prove himself as worthy and become as popular as his predecessor. We feel sorry also to lose the excellent service of such able workers as Messrs. Kathavate, Patel, Majumdar, Dutt and Manvikar who spared no energy in the cause of the Gymkhana. We feel confident that the new members will follow their example and do as much and even more for it. The members of the Gymkhana and Magazine Committee are :—

President....................	H. H. Mann Esq. D. Sc.
Vice-Presidents	J. B. Knight Esq. M. Sc.
	W. Burns, Esq. B. Sc.
Chairman....................	S. L. Ajrekar Esq. B. A.
General Secretary	Mr. B. R. Bhadkamkar.

Secretaries for :

Tennis .... Mr. S. P. Sen.
Cricket........................ Mr. A. X. Rebello.
Football and Hockey ...... Mr. G. M. Abro.
Gymnastics .... Mr. N. I. Kangle.
Agricultural Association } Mr. D. K. Kale.
and Debating Society. } Mr. Fred J. Gonsalves.
Reading Room..............Mr. A. R. Neginhal.

MAGAZINE COMMITTEE.

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{ Mr. T. Lobo.

Managers { Mr. V. N. Gokhale.
{ Mr. G. B. Talvalkar.

Members { Dr. H. H. Mann, D. SC.
{ Mr. D. L. Sahasrabudhe, B. SC. L. AG.
{ Mr. B. B. Joshi.
{ Mr. Y. D. Waygyani.

The different Secretaries have taken charge of their respective duties and already begun earnest work. Mr. Rebello is striving hard to have a pleasant season in cricket. He has arranged several fixtures with local teams and some matches have been already held. We hope he will be able to get up a good team this year and win many of the *matches, particularly the Challenge* Shield Match. *Co-operation and* sound practice will stand us in good stead. Let our cricketers join all in the game with a good will and practice regularly bowling, batting and above all fielding if they wish to earn renown for the Agricultural College.

The Tennis Secretary has had to be busy owing to the fair weather prevailing which though propitious for enthusiasts in Tennis is keeping our farm too dry. We are glad to note that a new Tennis Court is being prepared on the college grounds opposite the chemistry block.

The Hockey and Football department is yet in its infancy, and has Mr. Abro as its secretary. He is just the man for it and will, we hope, inspire enthusiasm among the students to join heartily in the game. Two matches have already been played and the results do credit for a team of tyros such as ours is. We hope Mr. Abro will be quite successful in

all he undertakes. He ought to be, since he has the lively co-operation of Prof. Burns, who, we are told, is very keen for the game.

There is an improvement in the Reading Room. A boy has been employed to look after the newspapers and keep the tables in order. We are in receipt of several magazines and as some of them are very valuable, it was resolved at the general meeting that they should be kept in the library from where they might be issued as library books by the students.

Accounts of the College Gymkhana for the year 1910-1911.

Receipts	Rs.	A.	P.
Last year's balance	319	13	3
Donations from members of the Staff	80	0	0
Fees	618	0	0
Fees from Tennis tournaments	8	12	0
Miscellaneous	8	2	0
Total Rs.	1034	11	3
To be recovered	200	0	0
Total Rs.	1234	11	3

Expenditure.	Rs.	A.	P.
Cricket	213	5	9
Tennis	344	13	5
Reading Room	115	11	3
Gymnasium	23	0	3
Agricultural Association and Debating Society	4	8	0
Hockey and Football	1	2	0
General Secretary	75	6	7
Total Rs.	778	8	0

Balance with Treasurer..........Rs...256-3-3

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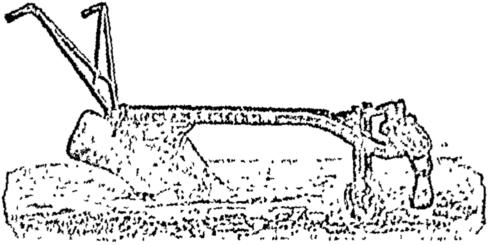

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By

Vishnu Narayan Gokhale

1911.

THE

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Magazine Committee.

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MANAGERS — { MR. V. N. GOKHALE. / MR. G. B. TALWALKAR.

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D. L. SAHASRABUDDHE L. Ag., B. Sc. — MR. Y. D. WAGYANI.

Notice to Contributors.

The Maga- at the disposal of Professors, past and present students as well as outsid- ring special interest in agriculture. All contributions should be written legib- on one side of the paper and are subject to such needful emendations may be consistent with their ideas and rejected articles will not be returned.

The Magazine will be published as follows —1st July, 1st October, 1st January, 1st March and contributors are requested to send in their contributions at least one month before the date of publication.

B. S. PATEL,
Editor,
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1911.

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CONTENTS.

THE CRY OF INDIA FOR RAIN.

"How long, O Lord, how long?"

The Poona Agricultural College Magazine.

Editorial.

WE write the introductory article to the Poona Agricultural College Magazine on this occasion under conditions in which one can have little but sorrow. For over a considerable portion of the country, and particularly of the Bombay Presidency the monsoon has been insufficient and famine seems the almost inevitable result. The rains broke very satisfactorily in the early part of June, and good progress was made almost all over the Bombay Presidency with the sowing of crops. But at the commencement of July there was a curious cessation of rain, and during what is usually the wettest month of the year, practically no rain fell in Gujarat or the Deccan. Early in August conditions changed in the Deccan. In the east, sufficient rain was received while in the west only just enough fell to prevent the crops from suffering seriously. Lower Gujarat had enough, but upper Gujarat and Kathiawar were practically rainless. As we write, the shadow of famine is over three British districts, the Baroda State in part, Kathiawar, and the States of Northern Gujarat, within the boundaries of the Bombay Presidency. Already fodder is scarce, the price of cattle has fallen to almost nothing,—and the *kharif* crops have largely withered on the ground. If the late rains are good, there is still hope that the worst may be saved,—but that is all.

It seems under conditions of coming distress that we ought hardly to speak of a joyous event such as the opening of the College buildings on July 18th by H. E. Sir George Clarke, Governor of Bombay. A full account of the ceremony will be found in another part of the present issue. It is very satisfactory that after long and weary waiting the Poona Agricultural College now has a worthy habitation. We are proud of our new buildings. They are certainly the finest in Poona—and possibly the finest college building in Western India.

The articles in the present number of the college Magazine will be found quite up to the usual standard and we may call attention to some of these which seem particularly worthy of note. In the first place,

there are two articles on potato cultivation. One of these is by our old friend Mr. R. S. Hiremath, and is descriptive of the methods adopted in the garden district round Belgaum, where intense agriculture is the rule, and land will bring a rent of Rs. 100 per acre. The other example tells of the economies practised and methods adopted in the far less favourably situated portion of the Kaira district round Umreth. This article is by Mr. M. L. Patel, B. Ag. whose home is in the very area of which he speaks.

We are often asked as to the actual condition of the cattle in an Indian village. Quite recently at Dr. Mann's suggestion, Mr. F. Gracias, G. B. V. C. took up the study of the cattle of a Deccan village, near Poona, with a view of finding out exactly what their condition is. He gives a preliminary account of what he found in the present number of the Magazine, and it will quickly be seen that his experience raises many points of great interest.

The cultivation of the lands bordering our great rivers is always peculiar. The soils are often very deep, very rich, and very well supplied with water,—and such lands are almost always considered to be of great value. The so-called *malai* lands by the Krishna river form perhaps the largest such area on our side of India, and the account which Mr. Bhadkamkar gives of what he found there will be recognised as of special interest.

We will only refer specially to one article,—that on the improvement of Khandesh cotton. The story which Mr. Kulkarni tells of the extraction of one type from the indefinite mixture which prevails in the Khandesh cotton as usually grown is a fascinating one. If the work is continued, and if the people can be induced to select the most profitable cotton for themselves, then, it certainly seems to mean a brighter future for this, perhaps (with Berar) the greatest cotton growing tract in the East India.

The number of the Magazine is issued at the beginning of the second college term of 1911. We again send it out, hoping that the information which it contains will be found valuable, and also that it will inspire others to collect and record facts of agricultural interest, wherever found, for the benefit of their fellow agriculturists of every kind.

OPENING CEREMONY OF THE AGRICULTURAL COLLEGE NEW BUILDING.

———:o:———

The following account of the opening of the Agricultural College Building by H. E. Sir George Clarke, Governor of Bombay on July 18th 1911 is taken from the Times of India, of the next two days.

HIS Excellency the Governor on Tuesday afternoon performed the opening ceremony of the new building for the Poona Agricultural College. The event is significant for it marks how the movement in favour of agricultural development in this Presidency has grown since its first humble beginnings as far back as 1878. From this institution will be turned out not what one might call complete farmers. Farming cannot be taught by rule of the thumb but only by experience; by men equipped at any rate to make the best use of their land and trained to meet any difficulties that may arise. Their value to the Agricultural Department is not small. From this source are obtained the experts who do such excellent work in advising the people as to the best method to pursue with regard to their holdings and also by suggesting how best to improve the lot of the agricultural population, north and south and east and west. Not only the Government, but also the Native States have realized the advantages to be derived from the employment of men thoroughly conversant in the agricultural problems, while private gentlemen and labourers have shown that they are in no wise behind the times by enlisting from this college trained men who will develop the land to the best purpose. In the matter of progress in this direction the Bombay Presidency can flatter itself that it has shown the way to the rest of India. How much of the success of the institution is due to the zeal and energy of the Principal, Doctor Harold H. Mann, it is impossible even to guess. Certain it is that but for his patient perseverance the College of Agriculture would not have been the force in India that it is at the present day. The inauguration of the institution is an earnest of the desire of Government to help the cultivators who form the back-bone of the country. But there are other and pressing calls upon the revenue of this country than agriculture and not all the eloquence of Indian politicians can extract from Government more than a certain, though ever increasing, sum. Sir George Clarke put the matter plainly by saying that more research work was continually required. The problems solved by Western countries did not always apply here. More

demonstration farms must be got scattered throughout the districts where the farmers can be taught. Evangelization work must be systematically pursued and the younger generation must receive a practical grounding in the elements of agriculture at rural schools. All this demands money. Surely it is not asking too much that some wealthy Indian philanthropist or philanthropists should come forward and contribute liberally towards the cause of agricultural education. There could be no better object.

There was a large gathering in the central hall of the new building to witness the opening ceremony. Decorations were conspicuous by their absence instead of the lavish display of flags and bunting associated with ceremonies of this sort. Fresh, green plants distributed round the hall at the foot of the stairs leading to the library under the dome and in front of the dais for the reception of the distinguished guests relieved the somewhat bare aspect. The Governor, who was accompanied by Lady Clarke just recovered from a rather severe attack of fever, was received on arrival by Dr. Mann and the other members of the college staff. Among those present were the Hon. Mr. C. E. Carmichael, the Hon. Mr. M. B. Chaubal, the Hon. Mr. G. K. Gokhale, the Hon. Mr. R. A. Lamb, Mr. G. F. Keatinge, I.C.S., Director of Agriculture, Mr. L. C. Swifte, Collector of Poona, and the Chiefs of Bhore, Ichalkaranji and Miraj.

Dr. Harold Mann, the Principal, in asking the Governor to declare the building open, said :—

Purpose of the College.

Your Excellency, ladies, and gentlemen, we meet to-day to formally open and devote to their purpose the buildings of the Poona Agricultural College in which we are assembled. They represent the present consummation of a movement which has been, with sets-back at various times, increasing in force ever since the most disastrous famine of the last fifty years—that of 1877. A wish to increase the resisting power of the people against a similar visitation by more widely spreading a knowledge of the most important of the agricultural discoveries of the West led to the commencement, in a very humble way, of agricultural education, especially intended for those who were to be leaders of the people.

Since that time the whole idea of agricultural education and its value in India has passed through many vicissitudes. After a course was established at the College of Science it was quickly neglected, and sank almost out of existence. Another revival of interest took place twenty years ago, but it rapidly passed away, and both the course and the students almost disappeared. Since the series of terrible famines from 1896 to 1901, however, a more stable and genuine development of interest in agricultural development and hence in agricultural education seems to have arisen. And the seal is put to the movement in that direction by the existence of the buildings to be opened by Your Excellency to-day.

Test of Success.

For these buildings represent in themselves not only an educational institution though education is their primary purpose. They are however more than this. They are the centre of a movement, which I think I may say is being felt more and more in our rural areas every year, in the direction of agricultural improvement. Let us consider for a moment the work which is done at this college as a centre. In the first place, this institution is a University College which trains men for a degree in Agriculture, obtainable after three years' work at this College. This is intended to be a course of as high a character as we can make it. The staff will not be content if it is less than the best agricultural course in India. The men whom we desire to turn out will certainly not be competent farmers, because there are certain aspects of farming which cannot be taught at any college, but they will, we hope, be men who will have the equipment necessary to obtain, after some training on an actual farm, the best results from the cultivation of whatever holdings they have, and a power to meet difficulties which may arise which they could not have otherwise. The course here is a very practical one. In the field every student has to cultivate land and do all the operations in connection with it with his own hands; he has, at another stage, to manage an area and present a balance sheet of the results of his management at the end of a year's cultivation. In the study of the sciences on which agriculture is based, an endeavour is made to have the same practical character predominant, and hence the necessity of the fine equipment of laboratories in the two buildings to be opened to-day.

I am often asked where the students whom we turn out go to. Some, and I think an increasing number, either go back to their family

estates, or else take up cultivation on their own account. The number who do this will really be the final test of the success of any agricultural college. Again, the Agricultural Department is staffed from the graduates of this College, and I am very proud of the work which our past students are doing in connection with it, and the enthusiasm which many of them continue to show in the work of spreading agricultural improvement among the people which is committed to their charge. Others again enter the public revenue service, in accordance with a decision of Government some years ago that the presence of men trained in agriculture is desirable in all departments which have to deal with the rural population. Others again are in demand for the services of various Native States. And now a demand is arising from private gentlemen and landowners for men trained here to manage their lands. I have for instance two applications for such men before me at the present moment. And there are other demands which time fails me to mention. I am looking forward to the time when we shall have representatives of the training given by this college all over the Bombay Presidency, and, even all over India.

During the last three or four years a demand has arisen for a different course. Many landowners' and farmers' sons who cannot attain to the high standard of general education which is rightly insisted on for our regular course wish to have the chance of obtaining the training in the best methods of practical farming which we can give. And hence, we have established a very popular one year's course in practical agriculture after taking which every young man leaves us to put the methods into practice on his own land. The total number of students varies between one hundred and a hundred and and ten. There is no present intention of going much beyond one hundred and twenty. But this educational work is only a part, though the primary part of our activity. We endeavour also to be a research centre in connection with problems relating to agriculture. Every member of our staff is expected to devote time to such work, in other words, is expected to be an investigator as well as a teacher. Inquiries keep pouring on from private farmers, from Government and from local bodies which demand research before adequate replies are given,—and there is almost endless scope for activity in this direction. The necessity of this work justifies the devotion of a very considerable portion of these college buildings to giving facilities for carrying it out.

Varying Activities.

But we are not only this. The college forms in an increasing measure a bureau of agricultural information. Inquiries are continually received amounting to thousands per annum, for information, for advice, for implements, or for seed, to the various departments of the college. Cultivators visit the place even from very considerable distances, and in increasing numbers. The officers of the college act as the experts of the Agricultural Department in their various lines, and I am hopeful that this aspect of the college work will continue to grow as time goes on.

To accomplish these various activities the buildings which we are assembled to open to-day have been designed. They were designed by the late Consulting Architect to Government, Mr. Begg, and carried through under the control of his successor Mr. Wittet. The actual supervision of the work has been in charge of the Public Works Department, and specially of the Executive Engineer of Poona, Mr. W. R. Lewis, and his capable assistant Mr. W. E. Dobson. The scheme has cost, including the purchase of the land, since its initiation about eight lakhs of rupees, while a further sum of Rs. 1,57,000 is sanctioned for the construction of a first class college hostel. The main college building in which we are met, in which all work, except that relating to chemistry and physics, will be concentrated, has cost Rs. 4 lakhs, while the smaller one devoted to these subjects has required a little over Rs. 2 lakhs. I am hopeful that a large number of our guests of to-day will be kind enough to inspect a large part of these buildings before leaving to-day.

I cannot cease without recalling to your notice the name of one who was the life and soul of this College scheme,—and in fact of the whole development of the agricultural department—while he was here. I mean Sir John Muir Mackenzie. From a very early part of his career, he devoted himself to the development of agricultural interests, and to no part of it more than to the improvement of agricultural education, and ultimately to the organisation of this College. Any inauguration ceremony would be incomplete which did not refer to his splendid services in this direction.

Your Excellency, ladies, and gentlemen, before I sit down I must thank you on behalf of the College Staff and myself for your presence here to-day. We are, one and all, anxious to make this day mark

another stage in the development of the great cause of agricultural improvement to which we have devoted ourselves. We feel that your presence to-day indicates your sympathy, and feeling sure of that sympathy we shall go forward with renewed energy to the work which has been placed in our hands.

SPEECH BY HIS EXCELLENCY.

His Excellency the Governor replying said:—Mr. Keatinge, Dr. Mann, ladies and gentlemen,—The saying that the best service that an individual or a Government can render is to make two blades of grass grow where one grew before, though hackneyed, embodies a practical truth too often forgotten. To India it is specially even vitally applicable. And I wish that Indians were more alive to its bearing upon the life of the people. The economic position of this country and the prosperity of the masses depend mainly and must always so depend upon the produce of the soil. That is an axiom which each recurring monsoon should impress upon our minds, and while the growth of industries, which is steadily proceeding, will serve to supplement the resources of India and will, to a limited extent, operate as an insurance against bad seasons, agriculture is the bed-rock on which the well-being of the vast majority of the people will continue to rest. Whether the food supply of the world is being adequately maintained is a great question on which I cannot enter, but in most countries, India not excluded, forces are at work which tend more and more to reduce the producers and to increase the number of mouths which must be filled by the labour of others. Highly industrialized countries, such as Great Britain and Germany, have ceased to be able to feed themselves. The United States, formerely a great food exporting country, will before long be in the same position, and meanwhile the population is steadily increasing. In the golden age of India when one was rich and happy, an age I frequently hear of but of which I fail to find any traces in history, the population must have been relatively small. During the period of British rule it has rapidly advanced to the enormous figure of 315 millions. The production of the soil still feeds this great number and famines have not in modern times entailed an absolute deficiency of the food supply of India as a whole, but only the enhancement of prices due to local scarcity and to the costs of transport. In the future a much larger population will have to be fed and it is probable that the number of producers will relatively decrease. What available reserves of land

exist to meet the growing demands cannot be exactly estimated. In the statistics for 1908-9 the cultivable waste other than fallow for all India is returned as more than 113 million acres. This is a larger area, but much of it, unless climatic conditions change, will never be productive without irrigation. In our presidency alone we have more than 7 millions of acres of such waste land, of which more than 5 millions are in Sind. When the great Sind irrigation project is carried out much of this waste will be turned to productive account and added to the nearly 3½ million acres already irrigated in that province. In the Presidency proper we had in 1908-9 about 893,000 acres of irrigated land to which additions have since been made, and when the fine project of the Nira Left Bank Canal which I earnestly hope to see begun before I leave India, is accomplished, there will be a further increase of about 850,000 acres. By means such as these a part of the available waste land of India will be enabled to add to the food supply of the people in the future, but much will remain waste for ever. Irrigation is possible only where the conditions are favourable, and while in specially dry areas projects entailing an annual loss are justified by reason of their great indirect advantages it is a sound general principle that the large schemes should pay their way. I have so far dealt only with the question of agriculture in its relations to the food supply of India, but there is another most important aspect of the matter to which I referred when opening the Agricultural Conference in Poona in 1909. The total export of articles of food and drink, the produce of the land in 1909-10, was valued at more than 32½ millions sterling, showing an increase in five years of nearly 4½ millions sterling. In the same year the value of the total export of the produce of the soil was about 81 millions sterling. This means that India received from abroad as profit from the cultivation of her land a sum more than four times the land revenue and 32 millions greater than the net total expenditure of the Government in that year. The immense economic advantage of this huge transaction must be evident, and there is an important added gain resulting from the surplus production. It creates a reserve available for the needs of the worst years and, as was shown in 1900-1, the export of wheat instantly dropped to trifling figures. I hope I have said enough to indicate the vital importance to India of her agricultural production. If that production can be increased the whole country will benefit immediately, and certainly now. The cropped area

of the Presidency, including Sind, in 1908-9 was more than 29 million acres, very nearly 20 million acres being devoted to food stuffs and pulses, and more than 3½ millions to cotton to which we allot a greater area than any other province in India. To jowari and bajri we assign an immensely larger area than any other province. Accurate figures giving the production of these areas are not available, but in my address to the Poona Conference I pointed out how low the average is in the case of wheat and other staples also do not nearly reach their possible output. When one is dealing with the huge areas under cultivation in India little imagination is needed to grasp the fact that even a small average increase of the present production would mean an immense total gain to the people apart from that which would accrue from improvements in quality and from the introduction of new products. And this brings me by what I fear must have seemed a tedious route to this College which represents in concrete form the earnest desire of the Government of Bombay for the greatest interest of India—the interest of the land. Dr. Mann has given us a sketch of the rise of this important institution from a small beginning. It started with the theory only. It is now largely devoted to practice Elementary classes which at first fell off in numbers developed into the training of a high standard with numbers of graduates yearly increasing, and the Poona College of Agriculture is now steadily growing in popularity and becoming a centre for instruction, for research and for the diffusion and reception of information of all kinds relating to the vital industry of India. It seems a long time since I visited this Institution, and I am very glad that before leaving India I am to have the honour of opening the new buildings which will add greatly to the comfort and convenience of the staff and pupils and consequently to general efficiency. The report for the last year should be carefully read by all who take a real interest in our cultivating classes. I find in it causes for hope and abundant proofs of steady progress, but also plain indications of the large amount of work that remains to be accomplished and of the pressing need for such work. The College now provides two courses: one of three years' learning to the degree and a short course of one year of which at first the success appeared doubtful, but which, I am glad to know, now has 12 promising students and is likely to grow in popularity as it becomes more widely appreciated. I hope that in time we shall obtain more students from the well-to-do classes, who after taking the full course would be able to add largely to the profits of their families

and would set an example of good farming to their tenants and neighbours. The students taking the one year practical course are all the sons of landowners, and I trust that they will also increase in numbers and turn to full account the training that they receive. I am glad to note that last year 25 graduates of this College obtained appointments, which shows an increasing demand for trained agriculturists and should prove an encouragement to others. I agree with Dr. Mann that Government should show special consideration to graduates in Agriculture for appointment to the Revenue service. The establishment of a Marathi school is a fresh departure which, if successful, will, I hope, be followed by a gujarathi and a Canarese school. The experimental work of the Department, though restricted by the other claims upon the time of the staff, has been important and valuable. It is to this branch of activity that we owe a great advance in the cultivation of Broach cotton in the Southern Maratha Country as plainly shown by the increase of the value sold at auction from Rs. 8,398 in 1908 to Rs. 1,11,455 in 1910, while the hybridized Kumpta obtained prices 7½ per cent. above the ordinary quality, and special seed issued from the Surat farm give an increased profit of 5 per cent. The growing demand for the seed provided by the department is a very hopeful sign, but we have yet to teach the cultivators that if they allow their seed to be indiscriminately mixed every year the advantage disappears.

In demonstrations, shows, district work, and the issue of publications, to all of which I attach great importance, there has been a marked progress. A total of 17 shows and 59 demonstrations and lectures, together with the formation of twelve new agricultural Associations during the year, indicate the growing local interest in the great cause of agriculture. The Deccan Agricultural Association has started *a useful monthly Marathi journal. There is a College* magazine to which students mainly contribute, while the many bulletins and leaflets issued by the Department have added largely to the knowledge available for those who are willing to learn. Much more might be said as to the work which the Agricultural Department is carrying on, but I must not detain you longer. I warmly congratulate the Director, the Principal, and the staff on the progress which they have achieved in the short time which has elapsed since this College was opened. The results they have already obtained afford a striking testimony to the zeal and ability which they have brought to bear on their important duties. I find only

one fault in our Agricultural Department. It is far too small in comparison with the needs of the cultivators and the vast magnitude of the task which it has undertaken. If I were an Indian politician I should worry Government in season and out of season to spend more money upon the improvement of agriculture and the acquisition and spread of knowledge. We require much more research work, because the problems of India are her own, and the careful investigations carried on in other countries may be valueless in our special conditions.

We want more demonstration farms where the cultivators can receive object lessons by which the advantages of improved methods can be brought home to their minds. I should like to see many more lecturers employed in going about among the villages to instil new ideas and to awaken interest. I think we should also establish rural schools where the elements of practical agriculture could be taught in the vernacular. All this requires funds. And the demands upon the Government are now so many and so insistent that we cannot do all we wish. This fine College is, as I have said, a proof of our earnest desire to help the cultivators, and you may be sure that we shall continue to do all in our power to extend the beneficient work of the Agricultural Department if the nature and the vast importance of this work were more widely known. I am certain that our many wealthy and generous philanthropists would come forward to help it realizing that there can be no better pooof of patriotism and no better way of promoting prosperity than the increase and development of the production of the land which lies within our power if adequate means were available.

In conclusion, I wish to say a few words to the students of this College. I hope you all feel that the profession of Agriculture is as honourable as it is ancient. Among the many educational institutions of the Presidency none is more practical or capable of doing more real good to the masses than this. I hope a time will come when the degree of *B. Ag.* will be held in the highest estimation and will be eagerly sought after by those who wish to promote the prosperity of India. What you are learning here can be turned to rich account hereafter, and while you may not be able to make two blades of grass grow where one grew before, because that means an increase of 100 per cent. of production, you can with absolute certainty add to the wealth of the country and to the well-being of its people. That should be to you an encouraging thought, and I warmly congratulate you on the line of life you have chosen and

H. M. Chibber, M. A., *Asst. Professor of Botany*

S. B. Bhide, M. A., B. Sc., *Asst. Professor of Physics and Mathematics.*

Rao Saheb G. K. Kelkar, *Assistant Professor of Agriculture.*

C. V. Sane, B. Ag. *Asst. Demonstrator in Agriculture*

S. A. Kulkarni, B. Ag. *Demonstrator in Chemistry*

V. G. Gokhale, L. Ag. *Demonstrator in Agriculture.*

P. Gracias, G. B. V. C. *Demonstrator in Vety. Science*

R. B. Kasargode, L. Ag., *Lecturer in [illegible]*

D. D. [illegible] G. B. V. C. *Lecturer in Vety. Science*

D. L. Sahasrabuddhe, B. Sc., L. Ag. *Lecturer in Chemistry*

wish every success to you individually and to the great cause of the land in which you can be act ve and patriotic missionaries.

In moving a vote of thanks to His Excellency for his presence there that day Mr. G. F. Keatinge said the kind words spoken by the Governor would prove a great encouragement to the Department of Agriculture as also to the members of the College staff and the students. The Hon. Sirdar Cooporswamy V. Mudliar *who seconded expressed* the keen *regret felt by all members of the community that the term of office of Sir George Clarke was so rapidly drawing near to its close. The Governor afterwards proceeded to the foot of the great staircase and breaking a cord which barred the way declared the College open* and wished it every success in the future. The various rooms with their many interesting exhibits were afterwards inspected by the guests.

Demonstrations & Exhibits on View.

Zoological Laboratory.

1. Wild silk moths of India, six framed pictures.
2. Moths of one of the above wild silk moths (*Antheraea mylitta*) with eggs and cocoon
3. Eri silk moth (*Attacus ricini*) in all stages.
4. Mulberry silk moth, in all stages.
5. Spinning of eri silk.
6. *Lac*, grown near Poona by Mr. T. R. Kotwal
7. Various wood-boring insects.
8. Various agricultural pests.

Laboratory of Plant Diseases.

1. Microscopic slides of fungi causing plant diseases.
2. Specimens of diseased plants.
3. Method of combating Grape Vine Mildew by Bordeaux mixture.
4. Methods of fungus culture.

Botanical Laboratory.

1. Mango grafting, Mango diseases, Mango fruits, etc.
2. Method of making microscopic slides.
3. Microscopic slides with drawings.
4. Experiments on the physiology of plants.
5. Fruits from Ganeshkhind Garden.
6. Fibres.

Herbarium.

1. Demonstration of methods of preserving plants.
2. Herbarium specimens and their arrangement.

Agricultural Museum.

1. Rocks from the Bombay Presidency.
2. Chief minerals composing the above rocks.
3. Soils from various parts of the Bombay Presidency.
4. Manures available in this province.
5. Crops suitable for green manuring.
6. Samples of crops grown in Bombay
   - *a* Jowar
   - *b.* Bajri
   - *c* Maize
   - *d.* Wheat
   - *e.* Rice
   - *f.* Millets
   - *g.* Pulses
   - *h.* Oilseeds
   - *i.* Fibres
   - *j.* Garden Crops and Vegetables
   - *k* Green Fodders.
7. Implements in use or recommended by the College for use in the Bombay Presidency.
8. Models of apparatus recommended for *gul* (crude sugar) boiling.
9. Dairy appliances.
10. Photographs of Dairy Animals.

Physical Laboratory.

1. Students working determining
   - *a* The gravity of rice seed.
   - *b* The saltness of water by determining the gravity.
   - c. The volume of fruits and nuts.
   - *d.* The energy required to raise a body by various combinations of pulleys, and other mechanical devices.
   - *e.* The atmospheric humidity.
2. The automatic waterfinder.

Chemical Laboratory I.

1. Milk analysis.
2. Separation of sugar and molasses by centrifugal power.
3. Machines for sampling
4. Determination of the value of manures by determination of Nitrogen.
5. Analysis of oilseeds by extraction of oil.
6. Analysis of soil,—determination of organic matter.

7. Lemon grass oil distillation.
8. Analysis of water for drinking—tests with Potassium Permanganate.
9. Determination of salts contained in soils.
10. Sugar analysis, Fehling's method.
11. Exhibition of Bombay Drugs.
12. Oils and oilseeds from Bombay.

Chemical Laboratory II

1. Detection of adulteration in flour by examination under the microscope.
2. Detection of adulteration in butter (two methods).
3. Determination of the stickiness of soils by flocculation.
4. Measurement of colours by the tintometer
5. Poisonous principles of plants (alkaloids).
6. Minerals of the Bombay Presidency, collected by students.
7. Rocks of the Bombay Presidency, collected by students.
8. *Typical specimens of minerals and rocks.*
9. Preparation of rocks for examination under the microscope.

Potato Cultivation in Umreth in the Kaira District.

BY

M. L. Patel, B. Ag.

THE special peculiarity in potato cultivation in this tract is that potatoes are taken as a winter crop as well as a summer crop. In the former case they are grown after the *koli* or red pumpkin a valuable garden catch crop, and in the latter case, they are taken after ginger.

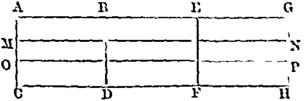
This practice of taking an irrigated garden crop like potatoes after ginger in the same year is analogous to the practice prevalent in Surat District of taking the small variety of Brinjals (*Solanum Melongena*) after ginger. This method is economical to the cultivators as they have to spend very little for manure and tillage, ginger being heavily manured with cattle manure and also with castor cake. Further more the harvesting of ginger leaves the land in excellent tilth. This is the most general practice, but in parts of Umreth other methods are adopted, the series sometimes being :—(1) *Bajri* (2) Potatoes (3) Sundhia *Jowar*.

After the field is ploughed once lengthwise, the *Handcar* (a wooden plank with a big stone upon it) is used to crush the big clods. After working this *handcar*, a second ploughing takes place across the line of the first cultivation.

Subsequent to this ploughing, one basketful of manure every four squre feet of surface is distributed. This comes to about twenty five to thirty cart loads per acre. There is also in vogue the practice of putting manure on the land soon after the removal of potato in March. This dressing of manure brings a good return of grass. Some cultivators supply manure to the potato lands every second year. Some quantity of manure before the grass and some before planting potato is calculated to yield on the whole very satisfactory results.

After manuring, the *handcar* is worked accompanied by the plough for the third time. Ploughing, using the *handcar* and crushing clods with a wooden hammer will be carried on again till the soil acquires a proper tilth.

When the soil is in a satisfactory condition the plough is used to make furrows and ridges along the length and breadth of the field. Furrows along the breadth of the field are at the interval of full two strides (about seven to eight feet). The area comprised within two consecutive cross furrows is known locally as "*Wari*".



AG, MN, OP, CH are the rows lengthwise.

Lines AC, BD, EF, GH are cross furrows.

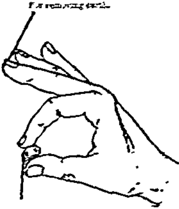
ABCD, or BDEF, or EFGH is a 'wari'.

The distance from A to B, or B to E, or E to G is full two strides.

After the cross furrows are ready, all the furrows and ridges that are deformed a little by working men and bullocks are repaired by hand and made convenient for planting sets and watering.

Cutting and planting sets:—As soon as sets are cut from the middle sized tubers, they are thrown in ashes so that evaporation may not take place from the cut surface. If evaporation is allowed from this part, seedlings will turn out weak, puny and unthrifty. In

October or in the beginning of November sets are put in the furrows at three inches apart and water is given immediately afterwards. A slight dressing of ashes before planting sets is deemed beneficial to stimulate good growth. In dibbling the sets care is taken to use as little pressure and friction as possible lest they should rub against soil. To effect this, the earth is removed with three fingers (little finger with the two adjoining ones) and then instantly a set held between the other two fingers (thumb with the



one near to it) is placed in position. The operations of removing earth and putting down sets take place automatically. The sets thus placed are afterwards covered with the same three fingers that were employed to remove the earth.

For one acre ten bags of potato of seven maunds each are necessary, a maund being twenty six lbs. This works out as about 1800 pounds of seed potatoes per acre.

Watering:—The first watering takes place soon after the sets are buried in dry earth. The second and third waterings are given at intervals of eight days. After twenty days when plants have attained the height of five or six inches, weeding and levelling ridges with a *Kurpi* commences. After getting all the beds flat within four days, fourth watering is done. Four or five days after this fourth watering, when the soil gets a little dry, new furrows are prepared between the rows and the fifth watering is applied.

After one month the crop should be in full vigour of growth and will henceforward require water every fourth day till the end of the second month. In the third month the crop will be ripening and will thenceforward require water again every eighth day. Watering is altogether stopped fifteen days before the tubers are removed from the ground. Weeds are to be removed as soon as they appear.

There will be usually cabbage, knolkol, cauliflower, radish and onion along water courses surrounding the potato *Waries*.. *Huli-chikka* (country sorrel) is also grown on bunds. *Red Harigi* (red amaranth) seed is sometimes broadcasted in beds of potato and young plants removed early for sale as a green vegetable.

When the crop is ready, plants usually have become bare of almost all leaves, and the haulms which are straight and sturdy in the second month, gradually become drooping and withering in the third month. Tubers are first dug up with a pickaxe as far as possible and then the plough is worked to stir out the remaining potatoes.

The yield is usually eight times the seed (i. e. 560 maunds to 600 maunds or about seven tons) and sometimes gives as high as ten to twelve times the amount of seed. The price varies from eight annas to one rupee per maund of 28 lbs. The total value of the crop varies from Rs. 280 to Rs. 300 per acre and may even bring Rs. 500 to Rs. 600 when the market is high on account of much demand from Dharwar and other places.

	Rs.	a.	p.	Rs.	a.	p.
Total expenses per acre:—						
1. *Cost of cultivation:—*				18	0	0
Three ploughings at Rs. 2-4-0 per ploughing per acre	6	12	0	✓		
✗ Using handwar three times at Rs. 1-8-0 per acre per time	4	8	0			
Crushing clods, 12 women at as. 2 each.	1	8	0			
Making forrows and ridges	0	12	0			
Making furrows neat and bedding by contract	1	8	0			
Cutting and planting sets, 24 women are required at as. 2 each... ...	3	0	0			
	18	0	0			
2. Cost of manure, 25 cartloads at Re. 1 per cart. ...				25	0	0
3. Cost of seed, 70 maunds at Re. 1 per maund. ...				70	0	0
4. Cost of irrigation :—				33	4	0

In three months about 19 irrigations (5 in the first month, 9 in the second month, and 5 in the third month) are wanted. For irrigating one acre in one day two pairs of bullocks (each pair worked alternately), two men with a mot and one man for regulating water in beds are required. The cost of this comes to Rs 1-12-0 per acre per time. Therefore for irrigations Rs. 33-4-0 are required.

5.	Harvesting an acre including digging also	... 10	0	0
6.	Rent per acre	...100	0	0
	Total Rs.	... 256	4	0

Net profit:—

Rs.	a.	p.
300	0	0
256	4	0
43	12	0

43 12 0, excluding Rs. 60 to Rs. 80 per acre secured for grass.

Full work can be had for three men and two pairs of bullocks on an area of four acres with one mot working on a well, fifteen to twenty feet deep.

Malai Cultivation along the Krishna Valley in Satara District.

BY

B. R. Bhadkamkar.

IN the month of May 1911 while I was with my brother at Tupari near Takari station in the Satara District, my attention was drawn to the cultivation of these *malai* lands.

My object of giving this information is due to three facts which I observed particularly. These are as follows :—

1. The same crops are cultivated each year on the same land.

2. The fact that these lands are considered of extreme value by the owners.

3. The crops grown are not of the great economic value that would be expected under the circumstances, and so there seems a considerable field for agricultural progress in the direction of introducing new and more valuable crops.

Considering the above three points I think it will be a good plan to give some information which I have collected of these lands and their cultivation.

It is rather difficult for me to give an accurate idea of the character of the *malai* lands. But I may say generally that the sloping areas

along the banks of the river Krishna which give so much pleasure to the eye and beauty to the river itself, are called *malai* lands, and with these also, the lands that are reclaimed from the river are included.

Owing to the very winding and zigzag course of the Krishna river, the population of a large part of the Satara District benefits every year, by the addition of fresh silt to their lands. This silt is particularly rich in organic matter and humus. It is supposed that a man possessing five acres of *malai* lands is far superior to a man holding fifteen acres of good ordinary soil.

The reclaimed lands are rather inferior in quality when compared to those that are covered every year by the floods of the river. This is due to the fact that these are not covered with silt in the same way each season. They are commonly known as *dagad* (दगड) lands.

Having understood the type of land to which this article refers we may now turn to see the kind of soil which is usually found in them.

Generally speaking, three distinct kinds of soils are found.—

(1) *Valusara* soils (वाळुसार) as they are called in the vernacular. These are mainly composed of very fine sand.

(2) Soils composed of silt which has been washed away by the waters of the river. These lands are commonly termed *Galwat* (गाळवट) lands or literally lands full of mud. The name itself is explanatory of the kind of soil which it forms.

(3) *Dagad* lands which I have already mentioned.

I. Firstly, let us consider the *Valusara* or the sandy soils as I have called them. These sandy soils can be further divided into two classes according to their situations:

a. Sandy soils on the steep slopes of the bank.

b. The sandy soils on the level.

a. Sandy soils on steep slopes:—These are purely composed of very fine particles of sand, quartz and disintegrated trap. The quartz gives them a whitish colour while the trap particles give them somewhat shining black colour. To an ordinary eye the soils present a somewhat shining greyish colour. The depth of these soils depends upon the inclinations of the slopes, but generally it varies from four feet to even twelve feet. By day these soils become so hot that you cannot walk through them. They are very porous and any excess of water is natural-

ly quickly drained away, only sufficient moisture being retained for the particular crops that are grown in these lands. Even in the hot weather we find these soils moist at the depth of four to six feet. Organic matter is usually present in very small amount.

b. Sandy soils on the level:—These soils do not differ very much from those on slopes, but they may vary in some parts to a small extent. In the first place, the colour tends usually to be a light pale red, slightly marked with black tints. If one walks through these soils, it is at the end of the field that the feet are coloured pale red. In composition these soils do not vary very much, but as their position is on level ground any small amounts of silt, washed down by the river, accumulates on these soils. The soils are light, friable and extremely well aerated

II *Galwat soils or silt soils*:—As the name indicates, these are mainly composed of silt washed down every year by the river. The situation of these soils is just above the level sandy soils with which I have just dealt. These soils take a middle position between the sandy and the *Dagad* lands. These soils are very highly valued by the cultivators, as they are extraordinarily productive. In the case of these soils the owner does not need to conduct expensive tillage operations. Further more the cultivator has no need to spend large and increasing amounts of money for manure. They do not need manuring at all, in fact, because a sufficient quantity of manure is added to these soils in the form of silt by the river waters. These soils are loose, well aerated and are of a light chocolate colour. These soils are most retentive and their water-holding capacity is also great. The peculiar structure of these soils allows full scope for the capillary rise of water when it is required. Rotation of crops is rarely practised in these soils. Some standard crops are grown every year, and the reason for this is quite clear, as they are annually renewed by the river.

III. *Dagad lands:—As has already been described these are lands* reclaimed from the river. The situations of these lands are just above those termed *Galwat*. As these are rarely flooded by the waters, they have become much more hard and compact than the former. In these soils, rotations are practised and these lands are even manured though not every year. As surface wash is a continual danger on these lands, the cultivator has to take much care about them. These soils are very

deep and also retentive, and will be found to contain a much smaller proportion of sand than the *galwat* type. In these soils the system of cropping varies in different parts of the district.

The method of cultivation of each of these types of land may now be described.

I. *Valusara Lands*:—

(*a*) *Sandy soils on steep slopes* :—The ordinary kind of agricultural operation such as ploughing, harrowing, and the like is not carried on at all on these lands. Generally the first floods pass away at the time of the festival of Ganesh Chaturthi fortnight of August. When these floods pass away and the soil is still somewhat moist, men are engaged to dibble the seeds. As it is very difficult, if not impossible, task for bullocks to walk on these sloping soils, as, far as possible hand labour is engaged. The following mixture is invariably sown by all the cultivators in these soils. They mix together four pounds of maize, four pounds of castor seeds, one pound of *shevri* seeds and four pounds of *pavata* (*Dalichos lablab*) seeds and dibble this.

This amount will sow a bighá. The dibbling is carried on with a small kurpa (खुरपं) or a special kind of spade (कुदळ). They dig a small hole by it and throw two and three seeds of the mixture. In this case the distance between the rows is generally from ten to twelve inches, and between the plants it is almost five inches. This distance between the plants and the rows is found suitable to the conditions and the people say that any change invariably results in a lower yield.

(*b*) *Sandy soils on the level* :—The working of these soils begins nearly at the same time at which the dibbling is begun in the sandy soils on slopes. Being level soils bullocks are freely used for work, and in these soils some previous tillage operations are conducted. When the soil is still somewhat moist, they are ploughed. As these are very easily workable soils a plough is used requiring two or two pairs of bullocks. There is no necessity of harrowing or levelling the fields. After the plough the cultivators immediately use the seed-drill for sowing the mixture that is mentioned in the case of the soils on slopes. But in this case the rate of the individual sorts of seeds is doubled and so it runs thus :—

Maize ...	... 8 lbs.
Pavata ...	... 8 lbs.
Castor ...	... 8 lbs.
Shevari ..	... 8 lbs.

There is every reason for the increase of the seed-rate. In this case the seeds are sown deep, and it is possible that some of the seeds may not germinate. Again, if some germinate there is the chance of some of the growing seedlings getting choked while they are coming up. Thirdly the seeds are sown by the seed-drill. In this case the distance between the rows is from ten to twelve inches as before. Almost all the cultivators do not conduct inter-tillage or weeding operations. Being sandy soils there seems to be no necessity for them, and if they were to conduct those operations, then the expenses of raising the crops would considerably increase. Beyond this, these soils are not much infested with troubles of deep-rooted noxious weeds. The free aeration and the looseness of the soils prevent to a great degree the growth of many weeds of this type.

Harvesting, Economic Importance of the Crops &c.

Maize —After four months from the time of sowing that is in the month of December they harvest the maize crop. With sickles they cut the plants keeping in the ground the stumps about three inches high. The plants are tied in bundles and kept in the sun for drying for about four or five days. After they are dried the cobs are taken off by the hand and the dry material is used for burning, as it has little or no feeding value. The cattle at least do not eat it with relish. In this district maize is grown not as a staple food crop, but it is often produced as a green fodder crop for cattle. No doubt it forms the food grain crop of the poor low caste people only, but it is not so much valued here. The immature green cobs are widely eaten by the people after partially baking them in a grass fire. For seed-purposes good stout plants bearing strong and healthy cobs are selected and after drying them along with outer membraneous coverings are kept hanging to the ceilings of the houses. At the time of sowing these cobs are taken out and the seeds are shelled out by hands and then they are sown.

Pavata .—The Cultivators mostly prefer the black variety of the pavata and reject as far as possible, the white one. The reason of this selection depends upon the economic value of the black variety over the white one. The black variety yields a better outturn than the white one. This pavata is sown mainly for fodder and less for seed production, it being seen that the foliage expanse of the black variety is far greater than the folinge growth of the white one. This black variety produces a bigger and stouter growth which is suited to the conditions of these soils.

It has also been found out by the cultivators that this black variety is distinctly preferred by the cattle for eating. These *pavata* creepers are not fed to the cattle while they are green. But they are fed after they are uprooted from the fields at the time of harvesting.

This *pavata* crop begins to ripen from the fourth or fifth month from the date of sowing. The first picking of the pods commences in the month of December and the next pickings are continued every week. These pickings last one month and by the end of January the pickings are completed. After this, the creepers are uprooted but are rarely cut. They are directly fed to the cattle or they are mixed with a particular kind of cattle feed which is known by the name of *Bhussa* (भुसा). This *Bhussa* forms one of the chief materials of fodder for milch cows and buffaloes and even for bullocks. This *Bhussa* consists of many things, the principal of which are as follows :—the dried leaves and haulms of ground-nut ; the thrashed ear-heads of the *jowari* and *bajri* crops ; the dried creepers of the leguminous crops of various sorts *i. e. mug, mataki, udid, masur, pavata* creepers &c. &c.

Castor :—From the beginning of the fourth month the fruits begin to appear on the plants and from this time the collecting and drying of the seeds is continued. The pickings are continued for six months that is, until the beginning or middle of May. The castor seeds are used for various purposes. The chief of which is for the extraction of castor seed oil which is generally used for burning purposes. The cake being unsuitable is not fed to the cattle but is vastly used in this district for the manuring of sugar-cane crops. A second but rather important use to which these castor plants are put is for fodder purposes for ordinary cattle. From the fourth month after sowing the young leaves and the top-shoots are fed to cattle. These leaves do not seem to have any special feeding value but they serve as an addition to the other dry fodder. Of course, one must remember that the nipping of the young shoots tends to the production of the new branches which are needed by the cultivator.

Thus these castor plants are allowed to grow throughout the year. When in the next year the floods come in, these plants serve two chief and important purposes from an agricultural point of view.

(1) At this time the plants become very big and send their roots very deep in the soil. When the floods come these plants stand

in their places and do not allow any soil to be removed by the running waters. Thus any soil wash is stopped.

(2) These plants serve to hold the new silt. The silt and mud is thus not carried away by the waters when the floods pass away and when the cultivators begin to plough the lands. These castor plants are cut off and are used for burning purposes or for building small cottages. They are much valued for roofing purposes.

Shevari:—This is chiefly grown as a fodder crop and it has no other value. From the fourth month after sowing, or when it is six or seven feet high the pruning of the plant begins. The young shoots at the top, and the side-branches are then cut and are fed to cattle. This pruning helps the plants to develop new side-branches and much green foliage. Being a fodder crop the main object of the farmer is the production of many side-branches and as much foliage as possible. Therefore they are pruned frequently by cutting with a sickle when they are nearly four feet in length, and feeding the prunings to cattle. The cows, bullocks and buffaloes eat this fodder greedily. Any dry fodder if given along with this *Shevari* is consumed by the cattle without any trouble. The ordinary farmers who are not in a position to grow irrigated lucerne consider this *shevari* as its equivalent. It is found that if milch cows and buffaloes are fed with ten to twelve pounds of *Shevari* every day, the milk produce is increased not only in quantity but also in quality. *Shevari* can be fed to any cattle in any month without any fear of harming them. But there is only one point which is to be specially noticed and if it is neglected then the result is said to be the death of many of the cattle. If it chances to rain in the month of March or April or in hot season, the *shevari* plants grow extraordinarily rapidly. In one night I have seen them grown to a length of two or three inches. If those newly grown branches of *shevari* are fed to any cow, buffalo or bullock, the animal is certainly made very ill, and often dies. Nobody knows the reason but there is no doubt as to the fact. Hence great care is taken about feeding hot season *shevari*. At this time nobody allows his cattte to run about in the fields of *shevari*. On the other hand, if there is no rain in the hot weather, and the *shevari* is fed to the cattle, no injurious effect occurs.

The *shevari* crop is allowed to grow in the field during the whole year, and then at the time of ploughing the field, the plants are cut and stored for burning or for thatching roofs. At this time of the year the

plants have grown to a height of fifteen feet and are strong and stout. Just as the castor plants serve the purpose of holding the soil in together and of preventing the surface wash at the time of the floods, so also do the *sherari* plants, and the cutting therefore takes place after the floods are past.

Outturn:—The average outturn of the crops may be taken down as follows:—

Parata :—8 maunds per acre.

Maize :— 4 ,, ,, ,,

In Tasgaon they only grow maize and castor and not *sherari* and *parata*. So the outturn of maize there rises much higher and varies from ten to fifteen maunds per acre.

Diseases :—*Sherari* and castor crops are not affected by any diseases when grown on *Malai* lands. *Parata* is affected by Aphis, or *papadi* (पापदी) as it is called. The leaves fall to the ground and the leaf growth is checked. The pods obtained are empty or only contain shrivelled contracted seeds. Though it is not a major pest yet the damage is very considerable.

Maize is attacked at the time of flowering. The inflorescence is attacked by white caterpillars which eat off the inflorescence itself. When the plants are thus attacked, the cobs remain quite empty. The seeds are not developed. *Kāndelurī* (कांडेळुरी) is the common name by which these caterpillars are known in the district in question.

II. *Galwat Lands* :—

At the time when the river water has completely gone down to its original course, that is, about the beginning of (आश्विन) September the cultivators commence the first operations on these fields of cutting down the matured *sherari* crop of the previous year. The individual plants are cut by means of a peculiar spade adapted for that purpose, generally known by the people by the name of *Bedage* (बेडगे). Near the base of the plant a small pit is dug by the hand and then, the plant is cut by the *bedage* deep in the soil.

When the soil becomes workable so that bullocks and men can safely go in the fields the ploughing of the lands begins first cross-wise and then length-wise. With a harrow having extra prongs attached to it, the soil is worked only cross-wise for three or four times. This

serves the purpose of pulverizing the soil to a fine condition. By this harrowing the clods that are formed are reduced to powder and the soil becomes quite loose and friable. If troublesome weeds like *Lavala*, *Harialı*, and *Dagad* (द्गाड), a kind of creeping and climbing weed, are present the land is worked again by a seed-drill without the tubes. After they again harrow the land twice at least then it is levelled. Special attention is given to this operation. By the floods a great deal of change takes place in the surface level of the lands and so people deem it best to level the land as far as possible. After this levelling they pack the soil by working on the soil the दिंड of a heavy big harrow. This is done with a view to conserve the moisture in the soil. The tillage operations, as will be seen, vary to a great degree from those conducted on any other ordinary lands.

After this, sowing operations begin. The mixture that is used is the same as that used in the case of the *talusara* lands, with the exception that *shalu jowar* is put in place of castor. This mixture is sown in the following way.

Patata is sown in each eightth row and usually maize also at the eighth row, but sometimes at the fourth row. It is found that if maize is sown at the fourth row the jowar does not grow nearly so well. The growth is, in fact, so much checked that the outturn is very small. The reason for this is, as yet, quite unknown. But maize at the eighth row does not materially affect the growth of *shalu jowar*. *Shetari* and *shalu jowar* are mixed and sown in the remaining rows.

Generally a four coultered seed-drill is used for sowing, while *patata* and *maize* are sown by the मोघण or one-coultered seed-drill.

In this land a special area is preserved for the plantation of the well-known Krishna Valley *brinjals*. The previous operations of these *brinjals* are rather different and so I think it worth giving a few lines describing it. The preparation of the land is of two kinds.

1st way :—The land is prepared just as in the case of land for *shalu jowar*, *shetari* &c. &c. and then in this prepared soil the *brinjal* seedlings are transplanted, the distance each way between the plants being thirty inches.

2nd way :—The seedlings are transplanted into land which receives no tillage of any sort not even ploughing. The distance between the plants is the same.

In the first method the field is weeded every eight days at first and then as the weeds become less and less the interval of days between weedings is increased upto twenty days or more, till all the *brinjals* are collected. Immediately after the first three or four weedings the space between the plants is harrowed by a peculiar sort of harrow, which is kept for this purpose alone. This constant harrowing forms an excellent mulch over the soil which helps greatly in the preservation of moisture. It also tends to stimulate the vigorous and healthy growth of the plants. By these harrowings, the lower part of the plants is covered by loose earth which serves as a sort of "earthing up."

In the second method, harrowing only is carried on every fourth day, by which means the expensive and troublesome weedings are rendered quite unnecessary. At the time when these plants attain a height of eight inches, pruning of the leaves commences. This operation is done without fail once in fifteen days, and is carried on till the plants stop yielding any farther crop. The importance of this operation cannot be over-rated. The first thing that is gained is the outgrowth of many side-branches by means of which the yield of fruit is increased to a great extent. Again, the plant sap instead of being washed in the production and nourishment of new leaves is utilised for the development of the fruits. The plants when fully grown appear like a bush about four to five feet high. The plants begin to bear from the third month, and the plucking is carried on every eighth day till the plants stop yielding. With sticks in their hands, the men turn up the branches and leaves of the plants by which the *brinjals* are visible and then with one slight jerk the fruits are pulled off. The first pickings yield *brinjals* large in size, slightly grey, with purple lines, somewhat sweet in taste—a peculiarity of the *brinjals* of the Krishna Valley. The seeds in these *brinjals* are very few in number. The fruits weigh from four to five pounds each. As the plants become older and older the number of fruits obtained decreases and they become smaller and smaller with a change of taste also. The number of seeds also increases. They are, however, produced until the month of June, when the last picking is over. The plants are generally uprooted and used for burning purposes. But sometimes some cultivators cut these plants keeping above the ground about three or four inches of the stalk and allow it to grow for the next year. This is practised but by very few on the reason that the outturn produced is very small, and the plants are apt to be diseased.

Though the yield of this crop is very heavy yet the want of a proper market has caused the return to the people to be comparatively small. A recent attempt to send the produce to Bombay direct was not successful as the returns were exactly equal to the expenses, as both road and rail journeys are long.

The Krishna Valley eaten raw, besides *brinjals* being a delicious vegetable, are an excellent medicine for bowel troubles,—the best way being to take them in an early morning.

For seed purposes a strong healthy plant is selected. The fruits of this plant are not plucked at all but are allowed to develop. The pruning of the leaves and branches is omitted in the case of such plants. The seeds are, consequently, better than those produced by plants treated in the usual way. When the fruits become quite yellow, which is the sign of full development, they are plucked and the seeds from these are taken out and are dried not in the direct heat of the sun but in the shade. These seeds are then used for sowing.

I have still to say a few words about the remaining important crop on these *Malai* lands, namely *Shalu Jowar*.

Shalu Jowar :—The varieties sown are *Laharaki* (लहावकी) and *Maldandi* (मालदांडी) or *Gunda* (गुंड). The ear-head in these cases is closely packed and long, with large grains. The colour of the grains is very light yellow. The bread prepared from the flour of these grains is preferred by all, and the taste is peculiar, but pleasant. The outturn is heavy, nearly more than double per acre that of an ordinary *shalu* field. This Krishna Valley *shalu* is well-known and so it is needless for me to further dilate upon its importance.

Other crops that are taken in these *Galwat* fields are generally vegetables, which have been recently introduced with considerable success. Such crops under ordinary circumstances would necessarily be irrigated in the hot season. But the peculiarity of these lands is that irrigation is never carried on. In the Karad and Tasgaon Talukas, a variety of vegetable crops are grown particularly just after the floods have subsided. The land is ploughed and harrowed and then the following crops are taken: Potatoes, Cabbages, Radishes, Brinjals, Knoll-kol, *Dingri* &c. &c.

All these vegetable crops are grown just as an ordinary cultivator grows but in connection with potato-cultivation one peculiar and import-

ant point may be noticed. My brothers—the Kanitkars have found out by actual experiment that if the potatoes are sown as soon as the waters have passed away then and then alone the crop yields a profit, otherwise it is a complete failure. *If the sowing is even one month late, then the whole crop is spoiled and the potatoes when dug out are rotten.* Before April the potatoes should be reaped, as after that time they quickly spoil. This Krishna Valley potato, as we may call it, differs in taste from the ordinary one. The taste is somewhat sweet but the peculiar smell of potatoes is largely absent. These potatoes are said to require less time for boiling. Only the above vegetables are grown at present, but there seems scope for the increase in the variety of these crops.

III. *Dagda Lands* :—

As I have said these lands are inferior to those termed *Galwat* and hence the variety of crops is also limited to a considerable degree. In the Tasgaon Taluka we find only Bajri and Maize at the eighth row grown in these lands. But in all other places they invariably grow castor and tobacco. As the tobacco of these lands is considered the best for chewing and smoking purposes some short notes on its cultivation may be found interesting.

Tobacco. The seeds are mixed with ash and are broadcasted on *a separate seedbed in the month of Ashadha* (आषाढ). *The seedlings are* ready for transplanting in the beginning of September, the latest date being at the end of September or beginning of October. The seedlings are transplanted when they are about three to four inches high, the distance between each plant and each row being thirty inches. After two or three days of transplanting a man goes in the early morning to fill up the gaps and at the same time pulls out those plants that are not well grown. Till the crop is matured many weedings and much inter-*culturing is done, but I am not going deep in that subject here.* This crop is allowed to stand in the field throughout the year. The *outturn* is nearly six hundred seers per acre. Some cultivators take a rotation crop from the cut stems of these plants. This is known in Marathi as खुटा सराणी. This rotation crop is not a profitable one. The outturn is about one third of the former, that is about two hundred seers, and the quality is inferior.

The tobacco on these lands is subject to several diseases, when the plant is about four or five inches high. Then the leaves begin to

shrivel and contract and they do not broaden. This condition of the leaves is commonly called as घुरड़ों. Again after the seedlings are transplanted a black caterpillar attacks the plants. This caterpillar is known by the name of Humani (हुमणी). Between two leaves this caterpillar builds with the aid of the plant, a small thick knob inside which the caterpillar lives and slowly eats away the leaves. By this the further growth of the plant is prevented and the leaves begin to fall off. The preventive measures adopted by the cultivators in this case are as follows :—

(1) When the cultivator comes to examine the plants in the morning he finds out knobs which are readily detected and cuts these with a khurapa and kills the caterpillar inside.

(2) A small area at the base of each plant is dug into which the caterpillar falls and can be caught. These caterpillars are collected and killed. This digging of a pit is done at the time when the cultivator sees that the leaves of the plant are drying.

(3) The tobacco fields are kept quite clean. Any sort of weed is not allowed to grow between the plants or rows. It is found that by this method the attack of these caterpillars can be held in check.

Our Konkan Staple Crop.

BY

M. N. Padwekar, B. Ag.

(Concluded from our last.)

In the case of *rabi* rice, the method slightly differs. *Rabi* rice is planted in the southern parts of the Ratnagiri district,—and is known as *Waigan Bhat*. *Waigan* rice is an irrigated crop. Having harvested the *kharif* crop, water is let in the field and is stored there for a week or so, so that the stubbles get decayed, and weed seeds are destroyed. The soil also becomes soft and can be easily worked. The water is not required to be removed as it evaporates or is lost by percolation. Having ploughed the field a few baskets of cowdung are spread in the field as a sort of manure. The quantity of cowdung however is very small owing to the small number of cattle in this tract and secondly because of the transformation of cowdung into cakes for fuel. The urine, though of so much importance is never cared for. The field is then ploughed and well prepared for sowing the seed. If however cowdung manure be scanty, dear fish manure or any other cake manure is applied. If possible the soil is well prepared to secure fine soft surface condition. While these preparations are going on the seed paddy is being made ready for sowing. The seed paddy, as mentioned before, is stored in a *Mudi*. The *Mudi* is then taken out, loosened and then kept on a big stone or on a high place under the pressure of a stone, which does not allow the grass to blow away. Boiling water is then poured on the *Mudi* followed by a few buckets of cold water twice or thrice a day. This is practised for two or three days, that is to say, until the seed germinates. The germinated seed is then carried over to the plot to be broadcasted.

In the case of the rice crop to be transplanted which forms by far the greater part of the crop, the seed is sown in the first fortnight of June. Salt lands are sown in the latter half of June. The *Waigan* rice is broadcasted generally in the latter half of October or in the first fortnight of November. By the end of November the fields are green with the *rabi* crop.

When there is sufficient rainfall for transplanting and when the seedlings are about a foot high, the plot used as a seedbed is made wet

so that the plants can be easily pulled out. Generally four or five women are engaged in uprooting the seedlings required for transplanting one acre. The women finish the work before noon. At the same time the men are engaged in preparing a good mulchy soil by repeated ploughing. Water is let in the field so that it stands about ankle deep to knee deep in the field according to the convenience of the plot. The seedbed whence the seedlings are removed is also ploughed and made ready for transplanting the seedlings. When the field is thus made muddy by so many ploughings and levelling, the seedlings are taken over to a head land and transplantation is commenced. The uprooted seedlings are not spoiled even though they may be kept at home owing to some difficulty or objection for a day or two. Only they must be watered and kept in a cool place. The seedlings are transplanted by putting the bunches in the mud. The number of seedlings in a bunch as well as the distance between the bunches differs according to the nature of the soil. If the soil be rich, two or three seedlings in a bunch put in at a distance of about twelve to eighteen inches will thrive well producing a rich and luxuriant crop; but if the soil be poor and coarse it is considered necessary for the bunches to have about ten seedlings and the distance between the bunches to be about six inches. After this transplantation which takes place in the month of July, care is taken not to allow the field to get dry for at least a month. In fact a good deal of water is kept in the field or otherwise the seedlings die out

The after cultivation of the paddy crop begins with September as in August the stagnant water checks the growth of weeds as well as the entrance of labourers. When weeds are seen, they must be immediately rooted out. One weeding in September is more than sufficient as later on the plants grow taller and stronger and do not allow the weeds any room to hold their heads up. Weeding operations are entrusted to women, the farmer enjoying a short rest or recess. The women start for the plots early in the morning with bread and water for their meals of the day if the plots be not far off; but if they be at a distance, they have to go there with the intention of staying there for some days. Hired labour at this season is very dear, if available at all.

In the month of September there is very little water in the field, and in certain soils, after weeding a second crop is sown at a time when heavy showers are not expected for a week or so. Such soils are

known as *Dapiki* soils—soils producing two crops. These secondary crops are generally pulses such as *Tur* (Pigeon pea) (*Cajanus indicus*), *Pawta* (*Dolichos lablab*) etc. The seeds are dibbled carefully so as not to injure the paddy crop, by digging holes about an inch deep by means of a stick or *Loiti* or a weeding hook. *Tur* requires a week or so for its germination but the other pulses germinate in two or three days. These secondary crops do not grow luxuriantly in the beginning but when the paddy crop is harvested, they flourish quite amazingly. The reason of this growth is practically the light and free aeration as well as the moisture in the soil, that the plants get.

Rice flowers in September. The early varieties put forth the inflorescence in the first half of September while the late varieties flower in the second half. At this stage they do not require any heavy showers. The female flowers are supposed to be fertilized at noon when showers are not at all required as they then are supposed to obstruct and check the fertilization, turning the heads barren. In the case of the paddy crop, watching of the crop while the grain is developing is not required as the glumes protect the seed from being attacked by birds etc. What little watching is necessary is in the case of *waigan* rice which is voraciously attacked by birds in the seedling stage.

The early varieties are ready to be harvested by the end of September and the late varieties are reaped by the end of October *i. e.*, shortly before *Diwali*. The crop is harvested by reaping with a scythe keeping the stubbles about two or three inches above the surface of the soil. If there be too much rain at the time of harvesting the crop or at a time when the crop is nearly ripe the produce is much affected owing to the falling down of the crop as well as owing to the separation of the seed from the heads. The *Diwali* holidays occur at this time and it is probable that the origin of this festival was due to the human nature in being jolly and gay when there is plenty of everything. In some parts where the paddy crop grows as high as about six feet owing to the abundance of water and moisture, they have to take off the heads some how but then the straw becomes poor in quality, and is only useful for thatching the roofs of houses. Really speaking the straw obtained from late varieties is useless for feeding the cattle. The straw of early varieties is used as fodder, that of late varieties being used for thatching purposes. The average outturn of the paddy crop is about twenty maunds per acre, each maund of eighty pounds.

The subcrops grown along with rice such as *Pauta* (*Dolichos lablab*), *Tur* (Pigeon pea) etc., flower in February and are reaped in March or April, the yield per acre varying from two maunds to four maunds, each maund being equal to twelve Poona *pailis*. The outer husk of the seed is fed to cattle along with the green leaves but the plants are used for *rab* purposes only. The husk and leaves fed to cattle increase the quantity of milk.

Having harvested the paddy crop in October, such of the soils as have no other crop growing or as have got sufficient moisture are ploughed and levelled after breaking the clods. This is however practised by prudent cultivators. If the moisture be sufficient in the soil, they sow *Kadwa* (*Dolichos lablab*), *Mug* (Gree gram, *Phaseolus mango*), *Udid* (*Phaseolus mungo*) and, very rarely, gram (*Cicer arietinum*). After sowing the seeds are covered by levelling the plot. The crop is watered if irrigation be possible. Generally one weeding is more than sufficient for all the crops except gram which requires about three weedings. Generally gram is grown as a vegetable and not for seed. The crops are ready to be harvested by the middle of March. The creepers of the plants are fed to cattle. The yield per acre is about two to four maunds per acre as before but the cultivators prefer to sow *Tur* etc. as a subcrop as the expense incurred is much less. The sowing or rather the dibbling of the subcrops grown along with paddy is effected by women each woman daily dibbling seed sufficient for five gunthas.

The soils which have become barren or which are such as do not hold water in the rains are also treated at this time. If it be found that even leguminous crops cannot be successfully grown, the soils are ploughed and exposed for drying. When the soil is dry it is collected by means of a *petari* or in some cases by baskets and removed elsewhere. The soil is removed in such a way as to produce so many pits which are then used for collecting water in them. The fields are kept fallow for one year at least. Later on the subsoil becomes the surface soil and owing to flooding the soil improves. In fact, the fertility of the soil is restored and the outturn is said to go on increasing year after year for some time.

Insect pests :—There are a number of pests and diseases attacking the paddy crop in the Konkan. A few of the commonest ones are given below.

Vit.—It is not positively known whether this is an insect pest or a fungoid disease. The ravages have been supposed to be due to some minute insects, which however have not been detected or seen by the cultivators In this disease the leaves dry up. It is supposed that the disease occurs if the manure added has been too great. Really speaking the disease has not been worked upon either practically or scientifically. Particularly this disease attacks the crops if the sky be cloudy.

Kid.—This is a stem borer of the paddy crop. It is seen located in the stem which is mostly eaten off and the crop has to be abandoned. No remedy is practised here. Akin to this insect there is another which eats off the leaves but the damage done is not so severe.

Kukadya.—It has much to do with the season. It often happens that after a good rainfall showers become rare for a number of days, and the sun shines brightly with scorching heat. The water stored in the fields is hence heated and a good deal of injury is done to the crop. The stem gets burnt and the crop eventually dries up. Even though this is apparently the real cause, the cultivators attribute the damage to a borer.

Karpa.—This is similar to Kukadya. In the begining the crop flourishes well and is in good condition but later on it goes on drying. The disease has much to do with the water supply. It may also be caused by an excessive amount of manure as the effect is seen generally in fields situated round about the village. Naturally enough these soils get a heavy application of night soil manure owing to their situation. The first showers, besides, carry off all the manurial dirt from the village and deposit it in the fields hard by. If the showers fail for a few days the crop is burnt and lost.

The crop has a few minor pests such as rice hoppers, grasshoppers, insects belonging to the bug family, locusts etc. but the damage done by these insects is such as not to be taken into consideration by the cultivators.

Luxuriant leafy growth :—As fatness is a disease in human beings so also luxuriant leafy growth is in crops. This leafy growth hinders the bearing quality of the crop and if not remedied the crop is lost. The only remedy is to cut off the grass-leafy growth-or to let in cattle to graze till the leafy growth is reduced to the normal stage of the crop. This must be however done in time.

Varieties of Rice :—Turning aside from diseases I may speak of varieties, of which I venture to present a list so far as I have been able to ascertain in my own district.

Sarwat, *Mahadi* and some of the coarser varieties from the third class are grown on poor soils which may be coarse or even stony to a certain extent. Lowlying lands usually grow *Ambemohor*, *Kamod* and such other finer varieties. The lowlying lands are generally fine in texture and get a layer of alluvial deposit. *Harkel* is grown on highlying lands. It may be grown on *warkas* soil on rare occasions.

Awned paddy is generally free from insect attacks.

Kharea Bhat and a few of the coarser and late varieties thrive well when the fields get flooded.

As regards the keeping qualities nothing definite can be said but it is a fact that if the paddy is not carefully stored it is attacked by insects which eat the rice. The germinating power has not been experimented upon. The germinating power of all varieties keeps for over a year but how long, cannot be definitely given.

If the statement be viewed for a time, it will be found that the finer the variety the greater the number of seeds per tola. It means that the grain is lighter and smaller. The varieties have got a number of sub-varieties, differing in size, quality and colour. This is perhaps due to soil and natural conditions of growth. An instance of selection may be given here. In some parts some fields produce paddy the grain of which is red in colour; the boiled rice prepared from these varieties appears as if mixed with blood but is otherwise an excellent rice. Even though a pearl white variety be sown in such a soil, in a few years the variety is said to change and be transformed into a red and coarse variety.

Many of the varieties will with difficulty be recognised by expert and practical farmers. Some of the varieties have a red husk but it is generally found that the redder the husk the whiter is the polished grain. In fact nothing can be guessed from the outer appearance as to the quality of the rice except by expert and practical men.

Colours of some paddy varieties are given below. The colours are mainly four.

I. White coloured paddy varieties :—

1. Rajawel. 2. Patni. 3. Taosal (may differ in colour). 4. Waksal. 5. Shepa. 6. Panwel. 7. Malkudai. 8. Kudai. 9. Sarwat hibasad.

II. Flesh coloured paddy varieties :—

1. Warangal. 2. Kolamba. 3. Kothumbir. 4. Bar. 5. Bhadas. 6. Harkel. 7. Sarwat (Sonpel).

III. Red-coloured varieties are

1. Chimansal. 2. Tavsal. (both are longer). 3. Avachitan (grain rather flat). 4. Mahadi.

IV. Spotted varieties are numerous but the principal one is Kharen bhat. This does not keep for a long time being attacked by insects.

I may add a short note regarding the special use of some of the varieties.

During marriages, feasts, holidays, festivals and ceremonial dinners, the varieties generally required for preparing boiled rice, sweet-scented rice, sugar rice, spiced rice etc.—*Sakhar bhat*, *Keshari bhat* etc.—are *Rajawel*, *Kamod*, *Kabutar* and *Ambemohor*. These are fine varieties and stand in the first class. Besides they are naturally sweet and scented. They are not daily used as they are believed to produce bad colds and other similar diseases. The secondary reason is that they are rather dear. The cultivation of these varieties is limited in this tract which mostly grows varieties of the second and third class. These first class varieties are not of daily use even among the rich. The reason is that they are not easily digested and hence give rise to Dysentery. They require the addition of a large quantity of sugar, milk, ghee etc.

Some of the varieties are particularly used for preparing Pohe—an Indian preparation of paddy obtained by pressing the boiled rice, drying it, and then heating in an earthen pot called *khapar*. These varieties are so selected owing to their shape, size and flavour. Generally the grains that are long and flat as well as sweet scented or having any of the qualities are used. The varieties so used are :—

1. Kothimbir. 2. Jiragen. 3. Kabsal. 4. Tamsal. 5 Velehi. 6. Kolamba. 7. Tavsal. 8. Chimansal. 9. Bugadi and other similar varieties appearing in the second class.

These are used for such Indian preparations as *Modala*, *Khaparpoli* etc. They find a place on the rich man's table as boiled rice for daily consumption.

Bhudas, *sarwat*, and two or three other varieties form the best kind of bread. *Shepa* and *Warangal* are used by men of all communities for daily consumption, being suited and cheaper as well as tasty.

Rice is not turned into spirit but there is one preparation called *Anarasa* in Marathi which requires a sort of fermentation. The husked rice is kept in water for a day or two and completely dried. The rice is then ground into powder which tastes and smells acid. Gul (raw sugar) is then mixed in it and the mixture is made into circular cakes which are fried. What happens in the preparation of this sweetmeat cannot exactly be told.

There are a few more varieties of paddy requiring the attention of medical men. These varieties are Sonephal, Sarwat and Mahadi. These are specially valuable for invalids, being the most harmless and easily digestible. They are used in venereal diseases as well. These varieties, strange to say, grow well in poor soils. Of these Sonaphel is particularly used in cases where the patients suffer from poisoning, mostly reptile poisoning. Sarwat * is generally useful but Mahadi is particularly of value in cases where the patients are suffering from wounds. Why they are so valued cannot be well ascertained by ordinary men.

Here I may give a short description of transforming paddy into rice. This transformation is effected in two ways—one is known as *Surai* and the other as *Ukade* rice. In the case of *Surai* rice the paddy is lightly crushed in special grinding mills, generally made of wood and known as *Ghirat* (घिरट). The other method—that of *Ukade* rice is that the paddy is put in boiling water till it cracks a little. It is then got out, the water is oozed out and the paddy is dried best in the shade. If it is dried in the sun it is dried for a very short time. The paddy may now be turned into rice which is used for making *Lanji* or is even fed to invalids, after turning it into boiled rice. In villages this is generally prepared by women of the family the touch of low caste women being supposed to polute the paddy. The rice prepared has a peculiar taste. After preparing rice, the husk is thrown off and is used

* Sarwat is grown by broadcasting and requires comparatively little moisture.

for rabbing purposes, the husk known as *konda* is fed to cattle which then yield a larger quantity of milk as they say.

There are a few varieties which are easily husked. They are, Shepa, Warangal, Kudai, Wassal, Tavsal, Chimansal, and a few others.

Bhadas and Harkel are used for extracting starch which when mixed with lime is much used for white washing. The starch is also used by washermen and weavers to apply to the cloth.

The straw of the late varieties, as has already been stated, is useless for feeding purposes being coarse and tasteless. It is used simply for roofing the houses or for *rab*. The straw of early varieties is specially valued for feeding and is tasty and fine as well. It is much liked by the cattle of the Konkan, there being no *kadbi* or any other fodder crop with which to feed the cattle.

The average receipts and expenditure incurred in the cultivation of the paddy crop are given below. They are roughly calculated to an acre.

Expenditure incurred in soils which produce only *kharif* paddy.

				Rs.	A.	P.
Rab charges.				15	0	0
Kawal (cutting of trees etc.)	4	0	0			
Cutting charges	1	0	0			
Kemal or grass.	5	0	0			
Cowdung.	1	8	0			
Carrying the cuttings on the farm.	0	8	0			
Spreading the cuttings, cowdung, grass etc.	2	0	0			
Throwing cowdung, earth, water etc.	1	0	0			
	15	0	0			
Ploughing the rabbed plot.				0	8	0
Price of the seed paddy at 24 lbs. per rupee.				1	8	0
Ploughing charges of the field to be transplanted at 0-8-0 per ploughing (This includes the preparation of the field *i. e.* working up the mud &c.)				5	0	0
Uprooting the seedlings for transplanting.				1	0	0
Charges for transplanting the seedlings.				1	2	0
Binding and making some such minor arrangements.				1	0	0
Weeding charges.				0	10	0
Reaping the crop.				2	0	0
Gathering and conveying the reaped crop on the ground for separating the seed from the head, and separating it there as well as storing.				5	0	0
Total expenditure ...				33	05	

Receipts of the paddy crop.

Paddy grain at 33 lbs. per rupee	50 to	75	0	0
Fodder sheaves at 100 " "	...	7	0	0
Total receipts ...	57 to	82	0	0

These receipts depend upon the season. Even if we take one *khandi* as the outturn per acre we get Rs. 57 *i. e.* there is a clear profit of Rs. 23-0-0. These are however calculated charges. We have not here taken into consideration the assessment which is about Rs. 5 as well as the castage charges. In fact if what the cultivators say be believed, they get a net profit of about Rs. 5 to Rs. 10 per acre, excluding the rent they pay to the owner of the land.

Let me now take the cultivation of the subsoil as well as the charges and receipts.

Expenditure required in producing paddy crop ...	31	5	0
Charges for getting seed *Tur* at 3 pailis per rupee or	1	0	0
Pawta (Dolichos lablab) at 4 pailis per rupee ...	2	0	0
Dibbling the seed	1	0	0
Harvesting the crop.	6	0	0
Total expenditure Rs. ...	41	5	0
		or	
Rs. ...	42	5	0

Outturn of paddy crop with sub crops.

Paddy outturn with sheaves	57 to	82	0	0
Tur at 5 pailis per rupee	18			
or	or			
Pawta 6 " "	18			
Gali (stubbles of the subcrop)	3			
	78 to	103	0	0

In soils growing these subcrops they get a good deal of profit comparatively. The soils that grow *rabi* crops yield less as compared with these soils as can be seen from the figures given below.—

Ploughing and preparing the soil for the rabi crop ...	2	4	0
Price of the seed (Mug)	1	8	0
Harvesting charges	6	0	0
Total expenditure Rs. ...	9	12	0

Outturn of *Mug*	16	0	0
Guli (Stubbles etc.)	1	0	0
Total receipts of the rabi crop Rs...	17	0	0

The charges of the subcrop come to about Rs. 7 or 8 with an outturn of Rs. 2 but the rabi crop gives only Rs. 17 with an expenditure of about Rs. 10 and hence generally *Tur* or *Pawta* is grown as a subcrop.

From all these calculations it is quite clear that the cultivator is not much profited by growing a *rabi* crop and the general tendency is to dibble *Tur* or *Pawta* as it can be easily sown while inspecting the plot. This is one of the reasons why the Konkan produces this *Pawta* crop so extensively. Besides it is easier to sow *Pawta* rather than *Tur* owing to the size of the seed.

It may however be mentioned here that the rice lands in the Konkan have practically no rules of rotation as such, the same soils growing rice year after year. This is due primarily to the poverty of the tract but the ultimate result is that after some years they have to leave the soil fallow for some time. Secondly the absence of the rotation system is due to there being no suitable crop growing with the large amount of moisture present in the rainy season.

Statement giving the names of different paddy varieties, rates of paddy and rice sold per rupee etc.

Serial No.	Names of paddy varieties.	Approximate weight of unhusked paddy sold per rupee.	Approximate weight of husked rice sold per rupee	Amount of seed required per acre in *Pails (4 shers)*	Approximate outturn in maunds.	Sowing period.	Harvesting period.	Crop whether late or early.	Approximate No. of seed per tola	REMARKS.
1	2	3	4	5	6	7	8	9	10	11
	I Class.	in lbs.	lbs.	Pails	Mds.					
1	Ambemohor.	25	13	6	18	First week in June	Second fortnight in November.	Both	756	(In the case of early varieties harvesting takes place in the second fortnight of October) The rice is sweet and scented. It is very sparingly used there being no demand for the produce.
2	Kamod.	25	13	6	18	do	1st fortnight of November	Late		
3	Kabutar.	28	14	6	18	do	2nd fortnight of November.	do	1019	Sweet scented and fine varieties sparingly grown by rich cultivators for their use or for special reasons there being no demand.

4	Rajawel.	28	14	6 5	19	do	do	do	836	as such for these varieties. They are grown on lowlying and rich soils getting alluvial deposits which serve the purpose of manuring.
5	Jiragen.	28	14	7	18	do	do	do		
6	Kalisal (fine)	30	15	7	20	do	do	do		
7	Tamsal.	31	15	7	20	do	do	do	712	
8	Velehi.	32	16	8	19	do	1st fortnight of November.	both.	750	
	II Class.									
9	Chimansal	33	17	8	20	do	do	do	735	They have got many sub-varieties which are both early and late.
10	Warangal	36	18	10	20	do	2nd fortnight of November.	Late.	665	This variety is extensively cultivated.
11	Shepa.	36	19	10	22	do	do	do	702	Do
12	Kothimbir	32	15	8	19	do	do	do	676	
13	Kolamba	34	18	9	21	do	do	do	725	The area under this variety exceeds that under *Kothimbir.*
14	Waksal.	34	18	9	20	1st week of June.	2nd fortnight of October.	Early.	663	Sweet and scented.
15	Tawsal.	32	17	8	18	do	do	do	563	Sweet and fine.
16	Kalisal (*coarse*).	34	18	9	18	do	do	do		Do

Statement giving the names of different paddy varieties, rates of paddy and rice sold per rupee etc.

Serial No.	Names of paddy varieties.	Approximate weight of unhusked paddy. sold per rupee.	Approximate weight of husked rice sold per rupee.	Amount of seed required per acre in *Pailis* (4 *shers*).	Approximate outturn in Maunds.	Sowing period.	Harvesting period.	Crop whether late or early.	Approximate No of seed per tola.	REMARKS.
1		3	4	5	6	7	8	9	10	11
		in lbs.	lbs.	Pailis	Mds.					
17	Patni,	38	18	10 5	18·5	do	2nd fortnight. November.	Late	494	Sweet but not fine.
18	Godwel.			10		do				Information not available.
19	Dabhol Patni.	38	18	10 5	18	do	November. 2nd fortnight.	Late	500	Sweet but not fine.
20	Kudepatni	38	20	11	19	do	do	do		Do
21	Gajwel.					do	do	do		Information not available.
22	Ghosalwel.	do	do	do	do	do	do	do		Do
23	Aiklombi.	do	do	do	do	do	do	do		Do
24	Wallai.	36	18	10	17	do	2nd week of November.	Late		Do
25	Bugadi.					do	do	do		Information not available.

	III. Class.									
26	Bhadas.	38	18	11	20	do	do	do	498	Grown in poor & coarse soils.
27	Harkel.	36	16	11·5	15	do	End of October.	Early	469	
28	Sonphal.	32	15	12	16	do	do	do		Do
29	Bodka.	38	17	11·5		do	2nd fortnight of November.	Late		
30	Panwel.	36	17	11	19	do	do	do	594	This may go even in II Class.
31	Mahadya-Warangal	36	17·5	10·5	20	do	do	do	665	
32	Malkudni.	38	17	12		do	do	do	684	
33	Dodka.	40	18	10·5	15	1st week of June.	2nd fortnight of November.	Late		
34	Avachieta	40	18	10·5	16	do	End of October.	Early	593	
35	Kundai.	36	17	11	13	do	2nd fortnight of November.	Late	609	
36	Bar.	36	17	12	18	do	do	do	581	
37	Mahadi.	36	17	11·5	19	do	October end	Early	551	
38	Sarwat-Mhasad.	33	15	14	13	Middle of July or in some cases July 1st week.	do	do	626	Broadcasted.
39	Sarwat-Sonepel.	33	15	13	13·[illegible]	do	do	do	766	Do
40	Kharen-bhat.	40	20	12	11 to 14	do	November.		572	Some varieties of this type ripen earlier The paddy has a peculiar though not saltish taste.

Cocoanut Plantation

IN

Western Portuguese India.

BY

S. P. Nazare.

DURING my short trip to the Portuguese territory of Goa during March of the present year, I happened to visit the cocoanut plantation of a friend of mine in the village *Sanquilim*.

As this is a very valuable and highly profitable plantation at the present time, owing to the rise in prices due to an increase in the demand for cocoanuts, I made a close examination of the methods adopted, and now beg to submit the result of my observations for the general benefit.

As is well known, the Portuguese territory of Western India lies below the western Ghats and bordering the Arabian sea. It has nearly seventy to one hundred inches average rainfall, and its climate is hot and moist, identical with the tropics, the summer being rather trying as compared with that of *Mallad* or *Maral*. As a result of these conditions, cocoanut plantation is very widely undertaken and is the source of much pride to the people.

Many of the classes of soil which are found are reputed to be particularly fitted for the plantation of cocoanuts. The best are formed of Laterite rock of loose texture, are rough and coarse, and are mixed with a considerable amount of sand. They are of a pale yellowish colour and are well, easily and naturally drained. Such soils generally lie along the banks of rivers that flow down from the Western slopes of the Ghats. Here, also *debris* and silt of manurial nature are particularly abundant, being brought down and deposited by them during their course from the slopes of surrounding hills.

For cocoanut cultivation some among these are differentiated and preferred according to their physical properties, situation and productivity. The classes of soil are as follows :—

1. Those that are entirely dependent upon the sweet water of the rivers or perrenial streams in the inlands away from the sea.

2. Soils that are on the banks of the sweet water rivers but also receive salt water from the sea which comes in during high tides.

3. Those that are solely dependent on the salt water of the small channels or creeks from the sea.

In the first kind of soils the conditions are all good but occasionally salt is given as manure as it is a necessary plant food for the cocoanut tree. *In the case of the second kind, no manure is required and these* are considered to be the best of all soils, for it naturally receives salt water as a manure in a required moderate quantity during the high tides only. Therefore here the fatal effects of excess of salt are naturally avoided and proper plant food is also got in moderate quantity. In plantations on such soils, very little is spent for occasional manures. Here the palm thrives well and gives a good yield. In the *third kind of soil near the salt water, the palm receives considerable* damage owing to excess of salt. It gives fruit in the fifth year of its life but its whole life is shortened to twenty five to thirty years, whereas in the second case it is prolonged to eighty years or even more. The cause of this,—so it is said—is the following. As the roots of the palm habitually do not go deep but spread out widely, so when they reach salt water level the tree gets gradually weaker and constrictions are formed on the stem. Then for the stability of the palm, supports made of lops of wood are placed at the sides to make it stand erect. In spite of this, however, it gets weaker and weaker and dies very soon for want of a proper quantity of plant food. This kind of soil is a contrast to the first, for, in the first kind of soil salt can be given as manure. But in this last case to supply the plant with the required quantity of good soil to withstand the poison is very difficult and costly as such land is always washed, at intervals, by high tides.

In commencing a new plantation, holes are dug three feet square and two and a quarter feet deep for one seedling and loose, friable soil from other places is put into them. Four such holes are dug in one day by one man, so the cost for each is one anna, the labour being comparatively cheap. Some rich planters prefer to dig holes five feet square and four feet deep costing three and a half rupees each which is not within the reach of ordinary cultivators. But the palm in the latter case is sure to give a very high yield and that too before sixth year, *for it gets the maximum space for the extension of its roots.* Then the distance kept between rows and plants is twenty-four feet.

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In these holes the seedlings which are grown by special professional growers are put one in each. Any man can grow these seedlings but they become inferior to those grown in a particular village *viz.*, *Bandavalim* in the Portuguese territory. For here they are well selected and grown in particularly good sandy soil. In addition the plumule is fostered carefully and grows faster than the radicle. Elsewhere the radicle grows faster and larger than the plumule, which is considered an inferior condition of things. The cost of each seedling is two and a half annas at present.

This planting is done in the month of April and each plant is watered every morning and evening upto the setting in of rains, *i. e.* for a month or two. During the rainy season, in any case, it gets sufficient water. Then in the month of October a ring surrounding the plant is dug and ordinary wood ashes is put in it and watering is given only on alternate days, for about three years more. The newly planted plants were either two feet high (which I was told were one year old plants) or four and a half feet high, which I was informed, were two years old. Then from fourth year, ash, salt heated soil are given as required every year, which costs four annas per year per palm including even the loosening of the surrounding soil.

Then in the fifth year beds of forty five feet square are prepared so as to hold nearly four palms. The vacant parts in them are occasionally ploughed lightly to eradicate weeds, to hold the manure washed away by the rains and to conserve moisture.

Manures as they use generally are four in number.

First. Fish manure is best but the best planters do not give it; for, by its application the plant is said to be exhausted quickly in spite of its good yield for some few years. So the majority rather tend to avoid fish manure.

Second. Simple salt is given every fourth year after the fifth year from commencement at the rate of twelve seers per plam, the cost being one anna. During the first five years salt is given at the rate of from one eighth of a seer upto one seer by a gradual increase to prevent destruction from white ants.

Third. In salty lands ashes are given every year in the month of November and December to ensure, so it is thought, the full development of the maximum number of fruits on the stalk.

Fourth. Heated soil is also given to plams and this has proved the best, at least on the plantation that I personally saw. It costs very little and is done in the following way.

First the soil is dug according to the quantity required and spread evenly on the ground two inches deep and over it wood loppings and dried branches are put and over that again a thin layer of soil of better character, less than two inches thick, is put, and the, woody central part is set on fire. When this is all burnt and slowly set down, the heated mixture is, after cooling, put around the base of the plam, three or four baskets being applied to each one, care being taken not to expose the expanse of roots. If instead of wood loppings, cocoanut fibres half dried and half fresh are put, it is said to be an excellent manure giving the best yield.

The average cost per plam from the beginning upto its fruiting in the sixth or seventh year is not more than one rupee. After this time, for each year a single palm demands for cultivation, manure, and other operations, an expense not greater than four annas. Such a palm, well cared for, gives nuts worth five rupees at the least while the yield may, at a maximum be worth ten rupees. There are four cuttings in the year provided pests and diseases are absent. The ordinary yield of a palm *is about eighty nuts and maximum may go upto* one hundred or even one hundred and fifty. So a single palm does not require a greater expense than twenty rupees as the total during the whole of its average life of sixty to seventy years. In some examples I have heard that grandsons are taking the outturn of the crop that was planted by their grandfathers taking neither any trouble nor planting any new trees.

Considering these facts, it seems to me that I must not conclude without suggesting that here lies a good field for those who would go in for farming on their own account.

Cultivation of Bamboo in Assam.

BY

Naresh C. Das.

BAMBOO is an extremely valuable crop from a commercial point of view, and it can be grown with a comparatively small amount of expense and care, provided the conditions are favourable. A garden of an acre may give annually an income of something like two hundred rupees nine or ten years after being planted, and, may continue yielding for forty to fifty years.

A light alluvial loam is best adapted for the cultivation of bamboo.

In the the district from which I come,—the Goalpara District of the Province of Assam, there are many varieties of bamboo, solid or hollow, thick or thin, strong or brittle, large or small. Only those varieties which are of good quality, much esteemed and used, and, which have a large demand in the locality in which they are to be planted, should be grown.

The bamboo is almost always propagated by suckers, as most of the varieties rarely flower. But there is one *kind of bamboo in Assam which bears fruit and can be propagated by it. This variety is small, hollow, thin, and is chiefly used for constructing fences or screens. The fruits are of about the size of a small guava and the shape is almost like the boll of cotton (*Waghad* variety), the lower end being acute and a little bit bending and the colour dark green. Recently a fruit which I brought from Assam, and which had a beautiful sprout on, though it was a little bit injured owing to my long journey, was given to the Economic Botanist of Bombay to grow.

Method of Cultivation:—In the month of Baishakh, at the beginning of the monsoon, holes are dug twenty feet apart, the depth of each hole being such as to cover the root and nine inches of the stem of the bamboo to be planted. Cowdung manure is put into the holes, and they are left in this position for a time. Then in the next month when the soil is sufficiently moist and soft, bamboos are planted. The culms for planting must be selected from those of the latest generation, those of the older generations having scarcely any suckers on them which can give rise to a new plant. Each culm must be dug out with the rods

* *Melocanna bambusoides*

care being taken not to injure, in any way, the buds that may be on them. In Assam the top portion of the culm leaving a yard or two below is cut off. The bamboo is then put slantingly into the pit and is covered over with earth. In the dry season, if the soil is not moist enough, watering should be practised in the first year of its growth only. But in Assam where there is plenty of rain throughout all the year, watering is not practised and there is no need for it

In Assam the bamboo is grown on the border line of the garden or *Bari*. The border line is raised by earth excavated just outside and close to it and bamboo is planted on this raised line of earth provincially known as "*Pagar.*" In Bengal a separate plot of land is specially kept solely for its cultivation

After treatment:—From the year after the planting of the bamboo silt or ash should be given every year in the month of *Baishakh*. If these cannot be obtained, fresh earth will do to a certain extent. This practice favoures the vigorous growth of the clump of bamboos. In Assam old, rotten straw, taken out from the roofs of the houses, is also applied to the clump when the bamboos are beginning to give fresh sprouts.

Another very successful treatment often given to the bamboo plantation with favourable result is to apply rice "*Bhusa*" or *Chita* or *Patan* as it is called in vernacular. This practice especially strengthens the clump and makes it more durable.

But beyond all these methods of treatment, which all in their own way are good, and, rarely fail to produce the desired effects, there is one, which can be recommended to the gardeners, in connection with bringing about the luxuriant and healthy growth of the bamboos. This is to set fire to the whole clump at its root in the month of "*Falgoon*" when there will be no new sucker coming out, and, then to apply earth to the clump in the next month. In the wild bamboo forests of Assam which are burnt every year at this time, nature thus assisted, most vividly holds before the wondering eye of man the utility of this practice.

Cutting of culms:—In cutting the culms care should be taken not to cut over much. For the first years of its growth no cutting should be made at all, or it is sure to interfere with the steady and vigorous growth of the clump. From the fifth year at most four ripe culms

may be allowed to be cut. But, nevertheless, the lower the number of cuttings the better. Then gradually the number may be increased. From a properly treated bamboo clump annually ten to twelve culms may be cut. Care should be taken to cut only the ripe ones and not the young ones which have growing buds on them, which suffer the most in consequence of the mother bamboos being cut off. No cutting should be allowed at the time when the new suckers are appearing or the people engaged in the job, may tread on the soft tops of the suckers and injure them.

Diseases and Pests of Bamboo:—Only one disease I know of, and, that interferes with the length and quality of the culm. This is the untimely rotting of the tops of the young suckers, when a few feet high. This disease is commonly prevalent in Assam and is known as "*Ag Mogha.*" The clumps attacked by this disease are very short, take a long time to ripen and are not fit to be utilised in any good and durable purposes. This disease may however be averted by according to them proper care and treatment such as has been described.

The insect pest, to which a large number of culms are liable, is the black ant. There are some birds and squirrels, that naturally prey upon their caterpillars, living inside the stems. They cut large holes into the stems and take them out and eat. Sometimes men use the caterpillar baits for fish. But the remedy serves to aggravate the malady. The birds and squirrels will spoil a large number of culms in search of their food. But it is needless to say that they do lessen their number, which would otherwise have been too numerous to check.

Improvement of Khandesh Cottons.

BY

K. D. Kulkarni,

Cotton Supervisor, Northern Division.

WHEN we first commenced our experiments in the improvement of Khandesh cotton in 1904, the first thing which became evident was that Khandesh cotton was a mixture of five types, having differently coloured flowers and differently lobed leaves. This fact of a recognised commercial cotton being a mixture is not peculiar to Khandesh cotton, the same is found, for instance in the Korkdi cotton from the Nizam's Dominions.

It was quickly found that these different types give a different quality of fibre, a varying ginning percentage of lint to seed cotton while they also differ in yield per acre. The types were separated from one another in 1905-06 by marking out each kind of plant, and picking cotton of each plant separately into five prominent groups as below:

Botanical name.	*Local name.*	*Characters.*
Neglectum rosea ...	Varadi ...	White flowered...Narrow lobed.
Neglectum rosea cutchica.	Varadi ...	do. ...Broad lobed.
Neglectum vera ...	Jari ...	Yellow flowered . Narrow lobed.
Neglectum vera kathavarensis ...	do. ...	do. ...Broad lobed.
Neglectum vera malvensis.	do. ...	do. ...Medium lobed.

These have now been grown separately for the last five years and the ginning percentages and yields which they have given are shown below. Each variety is indicated by the initials of its botanical name.

Variety.	Ginning percentage.					Yield per acre.	
	1906	1907	1908	1909	1910	1909	1910.
N. R.	38.7	32.1	37.6	37.6	37.4	870	1462½
N. R. C.	35.7	31.9	35	35.5	36.3	780	1209¾
N. V.	31.6	24.6	29.1	28.9	27.1	729	592½
N. V. K.	28.5	24	27.7	27.1	25	741	380
N. V. M.	very small quantity.		23.3	26.1	25.1	686	593

Before the year 1909, as only a few lines were being grown of these types, the yield is not given.

The net profit which we have got by growing "Neglectum rosea" or the narrow lobed variety of *Varadi*, on a larger scale instead of the other less profitable types is as below :

	1909.		1910.
	Rs.	...	Rs.
Extra yield of "N. R." in comparison with "N. V."	141	...	870
Extra yield of "N. R." in comparison with "N.R.C."	90	...	253
Increase of profit per acre of 'N.R.' over 'N.V.' owing to extra yield	20	...	124
Increase of profit per acre of "N.R." over "N.R.C." owing to extra yield.	13	...	36
Increase of profit per acre of 'N. R.' over 'N. V.' owing to better ginning percentage	26	...	51
Increase of profit per acre of 'N. R.' over 'N. R. C' owing to higher ginning percentage	6	...	5½
Increase of profit per acre of 'N. V.' over 'N. R.' owing to better quality	5¼	...	4

Thus it is clear that the total profit from an acre due to growing N. R., after deducting the loss in quality in comparison with N. V. in 1909 is Rs. 40, 12 as. while in 1910 it is Rs. 171, while in comparison with N. R. C. in 1909 the increase is Rs. 19 and in 1910 Rs. 41-8 as., taking 270 Rs. per khandi (784 lbs.) for *varadi* lint and 290 Rs. per khandi for Jari, according to present market prices. From the last year's results as to the mixture of Khandesh cottons in different talukas, we can say on an average that it consists nearly ⅓ of N. R., ⅓ of N.R.C. and ⅓ of N. V. M. and N. V. K. types and hence the cultivators who have taken the seed from us, got an additional profit per acre of Rs. 20 in 1909 and Rs. 70 in 1910, by growing the pure type only.

Owing to these enormous profits, the demand of this pure type is increasing by leaps and bounds and this department will not be able to cope with it. In fact it will probably be necessary for cotton growers *to increase their own supply by taking* from us *seed sufficient for an* acre. If this be cultivated carefully next year each of them will be able to sow his whole area with this pure variety. As for keeping the seed pure, this does not present great difficulty as small hand-gins will gin seed sufficient for each small cultivator's purpose, and larger growers can get their seed cotton ginned separately in a power gin.

There is moreover a considerable field for enterprise, in increasing the pure seed on a commercial scale, for our seed this year was bought at Rs. 1-8-0 per maund when ordinary cotton was only bringing Re. 1 per maund.

In Khandesh several Marvaris do gin the local cotton on hand-gins to sell for seed purposes and people pay a little higher rate for thi hand ginned seed. If the N. R. variety be kept pure and ginne separately there will be certainly a considerable demand for it for som years until cultivators generally have got this seed, after that time, i the method of picketing out the first two pickings out of the cotton o the best fields and ginning it separately be continued, this selecte seed will give still better results in yield year after year.

There is one other question in connection with the improvement o Khandesh cottons to which I wish to refer. The method of takin cotton crops on the same land year after year, or even for two years i succession is injurious both for yield, quality of seed and becomes a mean of spreading cotton diseases. Of course, many cultivators in Khandes take *Jowar*, *Bajri* and *Til*, in rotation, but few have come to an decision as to which out of these three is the best From my experi ence on the Dhulia farm *Til* is the best rotation and it also enriches th soil by its dropped leaves and flowers. The cotton crop also gives a bette yield and appearance in the following year. Between *jowar* and *bajr* as a rotation with cotton, the latter is better, because *jowar* seems t be a more exhausting crop than *bajri*.

Observations on Village Cattle.

BY

F. Gracias, G. B. V. C.

Demonstrator in Veterinary Science.

WHAT is the actual condition, in a normal season, of the cattle in an Indian village? What is the proportion of old, decrepit, diseased and useless animals? What is the proportion of useless young stock? What are the most common diseases or injuries or complaints? Such are questions which are constantly arising whenever the question of the cattle supply of the country is raised. To answer them involves a study of *all* the cattle belonging to typical villages, and it was with the object of making such a study that the observations here recorded were made.

The season 1910-11 was a good one,—rather better than normal, and, therefore, when the study was commenced in May 1911, the cattle were probably in rather better than average condition. The villages selected were within a few miles from Poona, and were easily accessible by bicycle. This fact will perhaps affect the results, but allowance can be made for this. The villages were Aundh, Dhapuri, and Bhopuri and it is believed that practically all the village cattle were examined during my several visits.

On the whole, the animals were in fairly good condition better than I anticipated. The cows were worse than the working oxen, and there is evidently a tendency to feed the latter better than the cows and calves,—the latter again being largely neglected, and fed with a little hay at the most, except when in milk. Beyond this they are expected to pick up what they can.

All except the working cattle are usually let loose to graze in the morning on pastures that have hardly any fodder on them during the dry or hot months. They return home in the evening almost as hungry as they went out, perhaps worse, and are tied either in badly ventilated sheds or are left to themselves in the open air. The most they are given is a few pounds of hay which the animals devour greedily. Milch cows however are given some grain and a little more fodder. The yield of milk is consequently poor and the owner draws out nearly all the milk he can get, leaving little or nothing for the calf.

Working oxen on the other hand are cared for very well. They are not only well housed but are given a good quantity of fodder, washed and groomed every second or third day and any little thing which is wrong with them is promptly attended to.

Nearly all the animals in these villages are Deccani; only one *Surti* cow belonging to a Dhapuri cultivator, in excellent condition and yielding a very fair quantity of milk came under my notice.

There is no system of breeding animals, all of them, as I have said before, are let out to graze, and in consequence a really very good cow may be covered by a worthless bull. I have not come across in the three villages a single bull which I could call decent for breeding purposes. The breeds found in these districts are the *Deccani*, Malvi and Khillari. Malvi and Khillari animals are mostly working oxen and are therefore seen in good condition. A few mixed Malvi cows I have come across during my visit. If only the people could be persuaded *to improve this stock by getting their animals mated by good* stud-bulls, I have no doubt the Deccani breed would be a very good animal for this part of the country. Besides the Surti cow one Gujarat at Kankrej bullock belonging to a *teli* (person who extracts oil from seed) was seen pulling the oil-extracting machine.

The Deccani breed serves the purposes of the agriculturist beautifully. It is a very good, strong enduring animal, having mostly short thick pasterns, good strong back, well set neck, irregularly shaped *horns and an* intelligent face.

So far no contagious disease was discovered among the cattle of the above mentioned villages. Foot and mouth disease was raging in these villages a few months before but at this visit I saw no cases. It is a highly contagious disease, attacking in fact in a couple of days all the animals of a village. It is mild however and very few animals even either succumb or are thoroughly disabled. The appended table shows the sex, disease and health of the animals of the three villages. Animals under the heading "debility" are those that are extremely weak; those that were suffering from the diseases marked against them were treated there as no coaxing or any inducement in fact, would convince the people that treatment in hospital would be very much better and safer; although they seemed to be satisfied with the treatment, they do not care for hospitals. They promised most faithfully to bring all sick animals, but I fear it was a mere bluff as no ani-

mals have since then been brought with the exception of two or three parturition cases. Such cases are first of all handled roughly by inexperienced people of the Gaoli caste; they destroy everything they get hold of in their manipulation and when the animal is thoroughly exhausted and on the point of death, they hurriedly cart her to the hospital; they then expect us to relieve the poor creature which in most cases is impossible.

The results may be summarised as follows :—

Aurdh.

Total Number. 251

- (1) Bulls 17
- (2) Oxen 97
- (3) Cows 89
- (4) Calves 12
- (5) Buffalo Bulls 0
- (6) Buffalo Cows 36

	Diseases.	Bulls.	Oxen.	Cows.	Calves.
Aurdh.					
1	Haematuria ...	...	1	...	...
2	Hoven ...	...	1	...	...
3	Conjunctivitis ...	...	1	...	...
4	Opthalmia ...	...	...	2	...
5	Actinomycosis ...	1	...	1	...
6	Hernia ...	...	...	1	...
7	Scurfy neck ...	7	5	...	...
8	Burns ...	...	...	...	1
9	Sprain ...	...	1	...	...
10	Tumour ...	...	2	...	...
11	Abscess ...	...	3	...	...
12	Debility ...	1	1	20	...

Bhopuri. 112

Total Number.

- (1) Bulls 5
- (2) Oxen 28
- (3) Cows 57
- (4) Calves 3
- (5) Buffalo Bulls 0
- (6) Buffalo Cows 9

Diseases.		Bull.	Oxen.	Cows.	Calves.
Bhopuri.					
1 Scurfy neck	...	1	4	...	...
2 Abscess	...	...	1	...	...
3 Debility	...	1	2	7	2

Dhapuri.

Total Number. 100

(1) Bulls 10
(2) Oxen 51
(3) Cows 23
(4) Calves...................................... 1
(5) Buffalo Bulls 0
(6) Buffalo Cows 15

Diseases.		Bull.	Oxen.	Cows.	Calves.
Dhapuri.					
1 Actinomycosis	...	1	1	...	...
2 Sprain	...	...	1	...	...
3 Abscess	...	1	2	...	...
4 Tumour	...	...	3	...	...
5 Scurfy neck	...	...	2	...	...
6 Debility	...	1	7	1	...

College News and Notes.

We are almost at the close of a season which, to us, who have made agriculture our life, is either the smiling harbinger of a luxuriant harvest and well-stocked barns, or the precursor of disaster and distress. The time we have passed through, during the past quarter, has been one of ever recurring doubt and uncertainty. During the long spell of dry weather, almost throughout the month of July, we felt the silent pleading of our thirsting crops for water, for rain. It grieved us to be able to do nothing for these parched suppliants save watch and wait. And we watched till the heavens sent down the welcome showers which came in pouring torrents in August to lighten our anxieties and to give our plants the rain which no resources on our part could obtain for them. But while our fields in the Deccan and the Konkan have been kept from absolute want, it is sad to think of the scarcity prevailing in other parts of our Presidency, where the heart-rending cry for rain is day after day mournfully augmenting. With kind sympathy, we join those who are waiting, "sad, dejected, weary, waiting" for the rain and make our humble suit to heaven that we be mercifully spared from the scourge that is threateningly knocking at our doors.

To turn to topics more cheerful, of all events since our last issue, the opening of the new College buildings by H. E. Sir George Clarke was the most eventful. The date fixed for the occasion was July 18th, a day happily coinciding with that of the incorporation of the University of Bombay, fifty four years ago; and undoubtedly, it must have been a day of joy and gladness and hope for the strenuous and pioneer workers in the cause of improved scientific agricultural education in the Bombay Presidency.

There could have been nothing so gay and yet so imposing in its simplicity as the aspect of the College buildings and grounds on the occasion. As announced previously, preparations were being busily made and hundreds of hands could be seen towards the week, prior to the opening, busy at work giving the final touches to and brushing up the college for its christening. Invitations were very largely issued and

the generous response to them could be seen in the large assembly of ladies and gentlemen that filled the spacious and beautifully simple hall—beautified for the occasion with nature's best ornaments—to witness the unveiling of this enduring monument to scientific agriculture in the Presidency—the *denouement*, we may well say, to the unwearying exertions of our principal, Dr. Mann.

H. E. accompanied by Lady Clarke arrived at the College at 5 p.m. and the proceedings were immediately opened by a speech by Dr. Mann. His Excellency also, before cutting the cord, spoke at great length. We have the pleasure of reproducing the speeches in a separate article, as they are brimming with interest and bespeak the zeal of H. E. as well as Dr. Mann for the promotion of agriculture.

The opening ceremony being over, the grounds and buildings were left at the disposal of the guests for inspection. There was a miniature exhibition and several interesting demonstrations in the subjects taught at the College were given. Neat little brochures containing a short history of the College and photographs of the buildings and professors were distributed as souvenirs of the occasion.

We all congratulate Dr. Mann most heartily, for his success in the regeneration of scientific agriculture in our Presidency and in rapidly raising by his untiring exertions the College buildings for the purpose of giving the youths in the Presidency as thorough a training in agriculture, as possible. Well may he be proud of this great achievement and right deserving is he of the thanks of all interested in this science. While congratulating Dr. Mann, we, the students, trust to do our best to gain a worthy name for the institution and pray that with increasing years it may flourish more and more and become the finest institution of its kind in India.

That there were many who evinced a great interest in the exhibition on the opening day was seen in the correspondence appearing in the local daily requesting that the show might be held again to enable the visitors to make a more minute study. Dr. Mann very gladly responded to this request and on July 31st, the college was again open to the public. A very interesting lecture was also delivered by Mr. Burns on the "Treatment of mango Plantation." H. H. the Chief of Ichal-

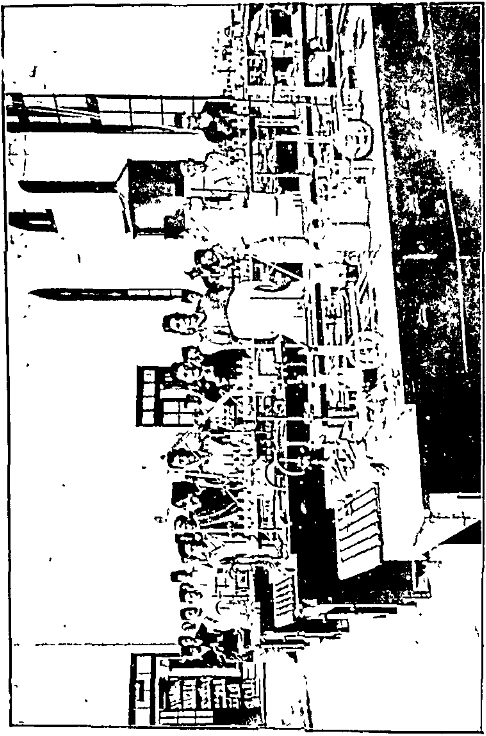
karanji was in the chair and a large gathering filled the college hall. The lecture was given under the auspices of the Deccan Agricultural Association.

The excellent ordering of the College leaves, we believe, nothing for the students to wish for except that the want of lavatories—which is a sore want indeed—be supplied as soon as possible. The daily stretch of five or six long hours in the lecture rooms makes the absence of these essentially felt and we would wish very much the P. W. D. would hasten to put an end to this discomfort.

The dispersion of the residential students in various places is also another trouble. Some are living on the farm, others near the Veterinary hospital and others again near the Boat Club. It would be long to enumerate the inconveniences and difficulties caused thereby, but one thing we fear this dispersion tends to isolate the members of the different messes. We trust that before long we shall be all happily living under the one benign roof of the hostel on the college grounds. It is much to be regretted that the hostel was not ready to be opened along with the other buildings but we may console ourselves that there is every chance of our having a holiday in the near future to celebrate right solemnly the inauguration of our new and permanent future residence.

We now betake ourselves to the pleasant task of wishing all our fellow students a pleasant and prosperous time during the second term. They have, we trust, refreshed themselves during the vacation,—some of them at their homes, others in the genial company of their friends at the quarters—after the hard and anxious days of the first term and are prepared earnestly to undertake the harder work now before them.

The college will again shortly wear the quiet aspect of the vacation as the "B. Ag." and "F. Ag." students will be leaving Poona on their agricultural and geological tours. The "S. Ag." students will be left all forlorn and will have to busy themselves with surveying and levelling. We tender our hearty wishes to all to the "B. Ag." and "F. Ag." that they may have very interesting and instructive days on their trips and return very learned and wise to fill our next number with



the notes of all they have seen and done and heard, the "S. Ags." that they make a correct survey and even attempt to outdo the Engineering students in their drawings.

We note with pleasure that the first year students are this year doing a good deal of field work. They have been allotted small plots of ground and are being practically initiated into the mysteries of the farm work that will fall to their lot in the S.Ag. class. We should expect to hear of excellent results this year in the F.Ag. examination in practical agriculture as the present students have a decided advantage over those who have already climbed that rung in the ladder of agricultural progress.

The second year men had several outings, for the practical study of entomology and plant ecology, to the Ganeshkhind and Empress Gardens. They also paid a visit to the Manjri Farm to see the sugar-cane growing there, and the manufacture of *gul*.

The date of the Social Gathering has been fixed this year for the 3rd of November. The day was chosen after deep deliberation by the general body of staff and students who met together to decide the matter. The date in November was selected as the rains in October last year prevented the sports being held on the day of the gathering. We hope that unanimous co-operation will enable us to make the occasion very enjoyable one to all.

We again have to offer our sincere congratulations to Dr. Mann on his being elected a syndic of the University of Bombay, President of the science Association of Bombay, a member of the advisory council of the Guild of Science in England and examiner for the ensuing M. A. examination. It does indeed make our hearts glad to see this increasing public recognition of the work and abilities of Dr. Mann.

We regret however that our joy has been marred by the very sad news we received a few days before the closing of the last term, of the death of Dr. Mann's mother. The news must surely have come to him as a severe blow. Although we have not had the happiness of being acquainted with her we doubt not she was a lady gifted with virtues fair, since they are so admirably reflected in her son Dr. Harold Mann.

We are sure the loss is keenly felt by Dr. Mann as he could not be by his mother's dying bed, but it must be a great consolation to him that he was able to see her at home quite recently. We offer Dr. Mann our kind and heartfelt sympathy and trust that time, the healer of all wounds, will calm his sorrow and heal this deep wound which heaven has been pleased to inflict on him.

The students of the college who were much affected by this sad news assembled in a meeting on August 30, and resolved that a letter of condolence be sent to Dr. Mann, expressing the grief and sympathy of all the students in his bereavement.

We hear with pleasure of the appointment of Mr. G. D. Metha, B. A., B.Ag., in the Imperial Agricultural Service. An account of his brilliant career has already appeared in our pages and his new appointment is assuredly well deserved. We give him our best congratulations, and wishes for a bright and prosperous future.

Mr. B. B. Price who was the senior assistant in the chemical laboratory has been transferred to Dacca, in charge of the laboratory there. Mr. V. A. Tamhane, L. Ag., has been appointed in his place here.

Mr. G. K. Kelkar, B. Ag., has been transferred from Manjri Farm to the Central Provinces. We have now several representatives in the agricultural service in those provinces, and we hope that they will continually remember their *alma mater* and seek continually to do her credit.

Messrs. V. G. Patwardhan, B. Ag., and D. D. Abhyankar, B. Ag., have joined the chemical laboratory staff, while Mr. S. R. Paranjpye, B. Ag., the former manager of this magazine has also done so in a temporary capacity.

College Gymkhana.

The season we have gone through has been very lively for the several cricket and hockey matches that were played. We are glad we were able to get up a team for cricket composed of some of our veterans and also some freshmen like Lalkaka, Bhandarkar and others. We regret however that we had not the pleasure of coming off best in any of the matches; this argues very much for better and longer practice in cricket than we now obtain.

We had again this year to play the college of Science for the shield competition. Our team going in first score a paltry 44, Bhadkamkar and *Lalkaka* playing a steady game and scoring fairly well. Our opponents responded with 102 runs. Our men started the second innings well but could not put in more than 75 runs. The College of Science had thus only 17 runs to beat us which they scored without the loss of any wicket. Mr. Deshpande did yeomen service in his wicket keeping and in playing a very good game of 25 runs in the second innings. Comparing the strength of the teams we may well say that we came off quite as well as we expected.

We congratulate the Fergusson College for their success in winning the shield this year. They won both the rounds in Poona against the Deccan and Science Colleges, and also the final round in Bombay against the St. Xavier's College.

Hockey is making headway among the games at the College this year, and many have taken very enthusiastically to it. A very good team has been formed among whom we have some fine players as Regi D'Souza, Lalkaka, the Masani brothers, Rebello and several others. Mr. Burns has been adding to the spirit of the game by playing in several of the matches. We are glad we are able to record one victory against the Police team. The last match of the first term was played against the Deccan College and though it was lost, our team played an excellent game indeed, and showed itself to have improved very much with a couple of months' practice.

The Secretary for Tennis has nothing particular to report. Many of the enthusiasts in Tennis are living far away from the court and hence there is not very much of active life. The tournament will commence shortly and we hope to see a large number of entries, good play and a healthy competition for the coveted medals to be presented on the day of the Social Gathering.

The Gymnasium is making steady progress and is well appreciated by the Kirkee Lodgers in particular.

We have had a series of lectures in connection with the Agricultural Association but the interest in this society seems to be somewhat flagging. The attendance at many of the lectures has been very disappointing and seems rather unaccountable. We hope to see the old zeal for the association revived during the second term particularly as the time and labour spent by the lecturers in working out their papers requires our hearty appreciation.

Dr. Mann opened the session by a brilliant inaugural address on the Life and Work of Pasteur. Other lectures of interest were "Poultry Industry" by Mr. Knight, "My last summer Tour" by Rao Saheb G. K. Kelkar, "Betel Nut Cultivation in Assam" by Mr. Das and "Tanning" by Mr. Padhye.

The programme for the second term is:—

Improvement of Indian cattle ...	... Mr. C. V. Sane., B. Ag.
Grape Culture	... Prof. Burns, B. Sc.
Ginger Cultivation near Gandevi (Surat Dist.)	Mr. R. K. Desai.
Young India and Agriculture ...	... Mr. V. R. Gadgil.
England's best act towards humanity ...	Mr. R. A. Lalkaka.
Manurial resources of the Bombay Presidency and how they can be best utilized.	Mr. V. G. Gokhale., L. Ag.

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THE POONA AGRICULTURAL COLLEGE MAGAZINE.

POONA:

PRINTED AT THE "ARYA-BHUSHAN" PRESS, AND PUBLISHED AT POONA

By

Vishnu Narayan Gokhale.

1912.

THE

POONA AGRICULTURAL COLLEGE MAGAZINE.

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Notice to Contributors.

The Magazine is at the disposal of Professors, past and present students as well as outsiders having special interest in agriculture. All contributions should be written legibly and on one side of the paper and are subject to such needful emendations as may be consistent with their ideas and rejected articles will not be returned

The Magazine will be published as follows —1st July, 1st October, 1st January, 1st March and contributors are requested to send in their contributions at least one month before the date of publication.

B S PATEL,

Editor,

POONA AGRICULTURAL COLLEGE MAGAZ

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CONTENTS.

A Grand Prize
Rs. 500
FOR AN IMPROVED SEED-DRILL.

OFFERED BY

Dr. H. H. Mann,

Principal Agricultural College, Poona.

HOW do you expect a good crop when the seed is sown haphazardly with a seed-drill, however thoroughly the land is prepared or manured?

Best Results can not be obtained by only good sound seeds of best germinating power and free from any admixture, but by dropping the seed with a *seed-drill which distributes the seed evenly and uniformly.*

Such conditions are not obtained in any tract of this Presidency. In Gujorath the sowing is straight in most of the tracts, but the uniform distribution of seed is seldom met with. A close inspection of the sown fields immediately after germination will reveal not less than twenty per cent. of the sown area in blank, without a single seedling. This state of things must certainly affect the out-turn. *This might be due to defective seed or seed-drill.* However expert a sower might be, it can never be expected that seeds will be dropped so regularly and evenly as by a machine. Being frequently struck with the present wasteful method of sowing *Dr. Mann has kindly offered a Prize of Rs.* 500 for an improved seed-drill.

The prize is to be awarded under the following conditions:—

1. The price of the seed drill should not exceed Rs. 50, the less the better.
2. The drill should automatically sow the seed at regular intervals in and between the lines.
3. The blanks left by the drill should not exceed five per cent.
4. The seed drill should be suitable for all kinds of soils.
5. The drill must be able to sow small as well as large seeds.
6. The model seed drill should be a full sized one suitable for working in the fields.
7. The drills will be tested by a Committee consisting of Mr. P. C. Patil, Divisional Inspector of Agriculture C. D., Mr. M. L. Kulkarni, Divisional Inspector of Agriculture S. D., and Rao Saheb G. K. Kelkar, Assistant Pro. of Agriculture. The Committee may cousult Prof. Knight and Dr. Main, if necessary.
8. The models of drills will be received by the Principal Agricultural College, Poona, to the end of May 1912. In case drills of similar pattern are received from more than one person preference will be given to the one that is first received.

All communications to be sent to the Principal, Agricultural College, Poona.

G. F. KEATINGE, I. C. S., C.I.E.

Director of Agriculture, Bombay Presidency.

The Poona Agricultural College Magazine.

Editorial.

WHEN the last number of the Poona Agricultural College Magazine was issued, famine over a very large part of Western India seemed to be imminent. We regret to say that what was then a prospect which might be avoided has now become a very serious reality. Northern Gujerat has had no relief: rain has been almost completely absent: fodder is almost non-existent and hence cattle are suffering seriously: these are signs of an imminent water famine,—and, though we trust there will be no deaths of men and women from starvation, yet it will be a terrible time of suffering and difficulty during the coming months. In the Southern Maratha country, the conditions are better. There were rains in the early part of October. These will have secured some sort of crop, though we fear only a small one. The Deccan is much worse off, and the condition is only a stage less serious than in upper Gujarat. Fairly general light rain at the end of November has put off the horrors of a fodder famine,—but the relief is, we fear, only temporary.

This failure of the rains,—the third almost complete failure in fifteen years,—draws attention again to what is undoubtedly the most pressing agricultural question in Western India,—that of how best to provide against such a failure, and how best to utilise the land in a region of small rainfall. Whether this can only be done by large irrigation schemes, or by the extension of wells,—or whether the crops on dry land can be made more secure by adopting better or different methods of cultivation, or by finding and using drought resisting crops is at present very unsatisfactorily known. It is, nevertheless, vital to know,—and the present disasters make it more emphatically necessary than ever that a large part of the energy of agricultural investigators, official or otherwise, should be devoted to settling the problem under our special conditions.

The present number of the Magazine will be found to contain a number of valuable articles. We would call attention to that on the "Value and Conservation of Cattle Excrement" by Mr. V. G. Gokhale, as being a distinct contribution to a problem about which little is known. The preservation of cattle excrement—whatever urine and dung—is certainly done very inefficiently in most of our districts. This we know. But how best to do it under our dry, tropical conditions is a very uncertain question. As connected with the management of cattle, we would also draw attention to Mr. Knight's article on the "Amrit Mahal Department in Mysore". We have, in a former number, given a description of the Amrit Mahal Cattle—the finest breed in India. In the present article Mr. Knight indicates how the government herds are managed in Mysore, and how the department which controls them is worked.

One article on fodder demands a note. This is by Mr. K. V. Joshi, now in charge of the experimental station at Alibag, on the "Supply of fodder in the Konkan." This district, though blessed with a heavy rainfall suffers much from lack of fodder, and Mr. Joshi's article will be found not only descriptive but suggestive.

We will only refer to two further articles. The first of this, by Mr. T. R. Swadi on his successful campaign against the rice grass-hopper near Belgaum. This is the first instance of the 'bagging' system being really successful on a large scale in Western India against any grass-hopper. The second article is by Mr. K. M. Pawar, the headmaster of the vernacular agricultural school, on some experiments made by the boys at that school. We are particularly pleased to have this article, and would wish that experiments on such points as those dealt with by Mr. Pawar could be multiplied to an enormous extent.

By the time the next number of the magazine appears, the College session of 1911-12 will be a thing of the past. The end of the term will be on January 31st 1912, having been specially extended by the University on account of the loss of time caused by the holidays on account of the coronation durbar at Delhi. We send out this number with all good wishes to all who are appearing for University or other examinations which follow shortly on the close of the term.

Address to Students

(Delivered on the occasion of the Fourth Social Gathering)

BY

G. F. Keatinge, I. C. S.

Director of Agriculture, Bombay Presidency.

Dr. Mann and Gentlemen,

IT gives me great pleasure to have this opportunity of meeting you here to-day to say good-bye to you all before I go on leave; and I much appreciate the compliment that you have paid me in asking me to address you. During the last four years I have watched the development of this College with the greatest interest, and though I am leaving my work for a time, I shall certainly not cease to take the keenest interest in all that concerns this college and the individuals who are connected with it. Four years ago this college was just starting on its career as an independent institution. Its buildings had not come into existence. The laboratory block was only half completed, and the central building where we are to-day had risen only a few feet above the ground. The hostel had not even been designed. Now you have two noble buildings, admirably adapted for their purposes and thoroughly well equipped; while your hostel has at last made its appearance above ground, and has given promise of good things to come. I confess that I am disappointed that the building is not already completed, and that I am leaving before your college has reached its final stage of building development. I realise the strain and inconvenience that must have been caused during the past years both to the staff and to the students of this college from the fact that the college has been housed in hired buildings in a way that was nothing but a temporary make-shift. But I feel that now you are nearly at an end of your trouble in this respect, and I take satisfaction in thinking that since you have done so well when labouring under these difficulties, you cannot fail to do better when these difficulties are removed, and you are able to settle down to work under more permanent and satisfactory conditions.

With your fine buildings, your well equipped laboratories, and your carefully laid out farm you certainly have an institution of which you may well be proud. You have convenience and facilities for study which do not fall to the lot of many, but which will, I am sure, be steadily improved until this institution attains to a degree of efficiency

for the purposes for which it is designed which is second to that of no other institution of its kind. This I know is the object which your Principal has at heart; and when he sets his heart on obtaining an object of this nature, I think that you may rest assured that he will obtain it.

It is not however of the buildings or the equipment of the college that I wish to speak to-day, but of the people who inhabit it. Your college will be judged in the long run not by the facilities which it offers for instruction, but by the careers of the students which it turns out, by the work which they do, and by the spirit which they show.

Now as soon as you take your degrees and leave this college the first anxiety of many of you must be to obtain employment of some kind. Whatever ideals and aspirations you may have formed the necessity for making your living must in the first instance press heavily upon many of you.

It is so in every country, and I think that it is pre-eminently so in this country where your family system and your custom of early marriage are apt to press heavily on many a young man who is starting his career. I do not say that your family arrangements have not many advantages, but I do think that they tend to make the Indian young man less of a free agent than is the case with the average young man in Europe, who is compelled less frequently than you are to look for immediate employment, and who has therefore more opportunity of shaping his career in accordance with his inclinations and his abilities, rather than in accordance with his necessities. However this may be, most of us have to work. The injunction laid upon Adam was this—" Thou shalt earn thy bread with the sweat of thy brow." There are some fortunate ones amongst us who are not compelled by sheer necessity to earn their living; but such men too owe it to society to work, and to pay their way in the world; and they certainly owe it to themselves to do so, for the idle man is seldom a happy man, and there is no satisfaction to be obtained so complete as that derived from the consciousness of duty faithfully performed. We are like machines; we must continually wear out and be thrown on the scrap heap. It is certainly preferable that we should wear out with honest work than rust to pieces by disuse. I referred just now to the necessity of working in order to make a living. Now I know that the Hindu Scriptures do not set great store by wealth, and the idea of an ascetic life of

voluntary poverty may be attractive to some. It is the same with other religions. The Bible describes riches as "the root of all evil," and the precept is laid down "Lay not up for yourselves treasures upon earth, where rust and moth do corrupt, and where thieves break through and steal." So too in the Parsi Scriptures, where the sage asks the spirit of wisdom whether poverty is good or riches, the latter answers—

"Poverty through honesty is better than opulence which is from the treasure of others." For it is stated thus: "As to him who is the poorest person, whenever he keeps his thoughts, words and deeds honest, *for him there is* lawfully a share of all the duties and good works which mankind shall do in the world. *As to him who is a man of much wealth, when the wealth is not produced by honesty*, even though he takes trouble in duties and good works and righteous gifts, his good work is not his own, but is his from whom the wealth was abstracted."

The crucial question therefore is not whether a man is rich or poor, but how the wealth was obtained, whether by honesty or by dishonest means. I remember once, many yeas ago, a lecturer in Political Economy asked his class the following question "How do profits occur?" and one of the students promptly answered "Because there are fools;" his idea being that wealth was acquired mainly by one man cheating another. Now something like this idea seems to be held by many people, and it is unfortunately true that wealth is sometimes acquired in this way; but cheating is certainly not a necessary or general incident in the acquisition of wealth. Profits occur and wealth is accumulated when a man has the ability and the energy to produce more than is necessary for his consumption, and has also the frugality to save the residue; and I think that there can be no doubt that every man owes it to himself and to society to try to develop his abilities and his energy to a degree which will enable him to pay his own way and to set aside some part of his earnings. The important thing as I said just now is that the wealth acquired shall be acquired honestly. Another important matter is that, when acquired, it shall be used wisely and well. If then you accept the ideas that I have tried to place before you, we shall be agreed that we want to work, that we want to make careers for ourselves, and that we want to acquire some wealth, or at

any rate, that we may rightly and legitimately aspire to such objects. The question that will shortly present itself to many of you is, how you are to do it.

In passing I may mention here that I notice with satisfaction that during the last four years a large proportion of the students who have passed out of their college have obtained posts in Government service. These posts provide for the men who obtain them an assured living, and open up to them the chance of honourable and useful careers. I certainly do not blame any one who wishes to enter Government service, the more so since that was the profession which I myself elected to follow. The fact remains however that it is not possible that all the students of this or any other college can be provided with posts in Government service, and a fair proportion of you will have to look for occupations elsewhere. The primary object of the instruction which you receive here is to teach you the theory and practice of efficient agriculture, and to fit you to undertake agricultural operations with success and profit. But the education which you receive here does far more than that; it should fit you for the battle of life in many other directions. You are taught here the principles favouring the natural phenomena which vitally affect the daily operations of these quarters of the people in this country; you are taught to observe and to think for yourselves. If you will only use your eyes your training can hardly fail to suggest to you lines of profitable development in the economy of the country side, in which you may take a useful part. If you read the old epic poetry dealing with the heroes of by-gone days you will notice that when a battle is described it is not the common people or the ordinary soldiers who are described, but it is only the heroes such as Arjun or Bhima who count in the battle. So it is in the modern battle of life. It is the select few, the intelligent, enterprising, persevering and honest who count, and not the thousands of colourless, mediocur men, still less the army of knaves and fools. We are apt to talk of the people of one country as being enterprising or energetic, and of another country as being unenterprising or slothful. By this we do not mean that the people of one country are all keen or of the other country apathetic or lazy; but simply that the proportion of keen and enterprising people in one country is greater than in the other country. The actual proportion of such people in any country is seldom large, and the addition of a very few recruits to the ranks of the mental and moral aristocracy may often make a great difference. With the training that you have received it is open to any one of you to take your

place in the upper ranks, and I would ask you to remember that one intelligent, industrious and honest man is worth more than many men who have not got these qualities, and that great possibilities lie before you if you will only grasp them. Things are changing fast in India. Industry, commerce and agriculture are all in a state of transition, and the cry on every side is for men to organise, and to bring practices and institutions into harmony with the near circumstances that have arisen. Look at agriculture. The idea is now generally accepted that agricultural practices and agricultural credit can be organised on a more effective basis, that progress is possible, that properties can be developed, implements improved, better seed and manure provided. Everywhere men are organised to undertake the necessary organisation, and for the most part they are looked for in vain. In such directions lie possibilities for anyone of you, openings which may bring profit to yourselves and advantage to the community. Some of you may not have the capital necessary to undertake such enterprise at once; but there are men with the capital who would be ready to embark in such enterprises if they could find competent men to help them in the work. What you have to do is to make yourselves competent to undertake such work, and to show that you are competent for the purpose. There are many points that I might elaborate in this connection, but I fear that I should weary you.

The most important opening, however, which lies before you I have reserved to the last; and that is agriculture pure and simple. Before recommending any one to take up agriculture as a profession it is necessary to be sure that he has the tacts and qualities requisite for a farmer. He must be fond of an open air and laborious life, prepared to work hard and fairly self-reliant. He must have common sense, courage and patience. It is the greatest mistake to think that any one can make a successful farmer. The characteristics mentioned above are necessary for success, and the man who has not got them or who is likely to sigh for the comforts and delights of a town life had better keep clear of the business. But for the man who has the right tacts and qualities there can hardly be a finer life or one from which more real happiness can be extracted. The change of the seasons, the countless natural phenomena, the manifold processes of nature have an interest and a lesson for the farmer which they have for few others. It is sometimes said that farmers seldom grow rich. This is, on the whole true; but riches are not everything by any means, and an occupation which will provide a healthy and happy life and a fair competence is certainly not to be despised. I noticed in a book by a

well-known French writer on agriculture that he stated that he had never known a farmer grow rich unless he had introduced some change into the system of farming that he found around him; but that where farmers did introduce suitable changes he had often known them become rich. It is in fact the man who can see what is needed and do it, while his neighbours fail to see or do it, who makes a success. The whole country side in India is at present calling out such changes. It is for you students to see them and to make them.

I fear that I have read you a long sermon. I know that you are in the situation of a very strenuous day; and I do not propose to detain you longer. I can assure you that I wish you all success in life, and that I shall follow your career with interest, and shall always be glad to help any of you that may need assistance. Before I close I will read you a few verses by the great Scotch poet Burns, which express admirably what I have been trying so imperfectly to say to you. I cannot read it in the Scotch dialect as it ought to be read; but I have no doubt that on another occasion if you ask the poet's namesake Professor Burns, to read it to you as it should be read, he will do so.

I'll no say men are villains a';
  The real, harden'd, wicked,
Wha hae nae check but human law,
  Are to a few restricked;
But, och! mankind are unco[1] weak,
  And little to be trusted;
If self the wavering balance shake,
  It's rarely right adjusted!

To catch dame Fortune's golden smile,
  Assiduous wait upon her;
And gather gear[2] by every wile
  That's justified by honour;
Not for to hide it in a hedge,
  Nor for a train-attendant;
But for the glorious privilege
  Of being independent.

The fear o' hell's a hangman's whip
  To haud the wretch in order;
But where ye feel your honour grip,
  Let that aye be your border;
Its slightest touches, instant pause—
  Debar a' side pretences;
And resolutely keep its laws
  Uncaring consequences.

1—Very—2—weath.

Cocoanut Cultivation in the Konkan

BY

S. R. Paranjpe, B. Ag.

THE cocoanut palm has always been one of the most attractive as well as one of the most useful trees of the tropics. Though at present its products form a very important item in the trade of India, yet the possibility of future development is still greater.

First with regard to the present trade, it is worthy of note that India exported 450,000 cwt. of cocoanut kernel in 1910-11, worth Rs. 79 lakhs, and oil of a value of Rs. 34 lakhs. Of this, however, very little was despatched from the Bombay Presidency, the value of fruits being only Rs. 10,473 and of kernel Rs. 21,130. There seems no reason why this trade from the Bombay Presidency, with its extended line of suitable coast on which to grow the cocoanut palm, should not be largely extended.

"The cocoanut palm is closely confined to the tropics. The centres of the geographical range of this palm are the islands and countries bordering the Indian and Pacific oceans. Its natural home seems to be somewhere between the eastern shores of Africa and the western shores of America, though it is now grown in some parts of America also. Wherever it ventures to go beyond these limits, it loses its power of productiveness."

In India alone nearly 500,000 acres are under cocoanut cultivation, and the whole of this area is stretched along the sea-coasts. In the Konkan it grows with great vigour on a long strip of land having a breadth of five to six miles from the coasts. They are inferior in size and quality, when grown further inland.

The cocoanut tree attains an average height of from fifty to hundred feet, having a diameter of one to two feet. Its cylindrical trunk, crowned on the summit with numerous waving leaves, called झावळी, having a length of nearly fifteen to twenty feet, forms an elegant object wherever it occurs.

This palm grows well in a low-lying, sandy-red or medium black, deep, well-drained, sweet soil, having an access to sea-breezes.

Like many other fruit-trees it requires planting and transplanting before it takes its permanent place. The best cocoanut seed is obtained from a well-grown healthy fruit of a cocoanut tree in its prime, when it is about twenty years of age. Fruits ripening in May are considered the best for seed. The fruit selected for this purpose is allowed to ripen fully on the tree, and is then taken down very carefully. It is not thrown down as usual, because this throwing injures the outer skin of the fruit, and thus it becomes of very little value as a seed.

This well-cared-for fruit is then kept in water for nearly six months; by that time it sprouts; this sprouted seed of cocoanut is called आवण. A seed-bed is prepared, in the shade generally of palms; but never in the shade of a mango, or a kaju tree. It is believed that the shade of these trees is injurious to the young plant. It would be worth while to see, if this is only a superstition or it has some real basis. In this properly prepared seed-bed, the above mentioned sprouted seed is put in; here it remains for a year, or so,—in some places for three years. But generally when the seedling gets three leaves, (called कवाथा in this stage) it is ready for transplanting into its permanent place.

This permanent place is prepared as follows:—A ditch is taken, which is four feet long, four feet broad and six feet deep; and the distance between two such ditches is eighteen feet. Half of this ditch, that is, nearly three feet is filled up by good soil mixed with some salt-sand, to make it porous; and in this the seedling is transplanted. Every year as the plant grows, additional soil is added; and thus when after five years it begins to bear fruits the ditch is completely filled up. One man getting four annas a day prepares one such ditch in one day.

The seedlings get a very small quantity of water before transplanting; but when transplanted each plant gets nearly four to six gallons of water every day. As it grows, it is given less and less water. First, the daily watering is changed to alternate days, and then it is given twice a week. In the rainy season no watering is required. Thus for eight months, for watering fifty trees, the small sum of two rupees eight annas is quite sufficient.

In the early growth of the tree no special manure is given, because the plant is liable to an attack of palm-weevil, and Rhinoceros beetle; and farmyard manure at this stage is stated to encourage the growth of

this enemy. In some places fish-manure is put in the ditch, and it has proved a success. Just about the third or fourth year, nearly one maund of farmyard manure is given to every tree, and this manuring is repeated once in three months. At times they put fresh dung as manure. Our system of manuring as we call it is a ring system of manuring. It is as follows:—First we remove the earth round the base of the tree, forming a ring at the base; then in this ring the manure is put, and the earth removed is mixed with it, when it forms a ring round the base of the plant, and also a basin for water. In rainy season we are required to cover this heap of manure, in the form of a ring, by the leaves of Red-castor or "Mongali Erand", which is abundant in our parts.

In its early days the plant requires to be protected from farm animals, sheep, and pigs, and for this a strong fencing of thorny trees is considered quite essential. In their early days the plants are also specially liable to the attack of the above mentioned insect pests, though at times these also attack grown-up trees. The remedy for this attack practised in the Konkan, is to find out an attacked plant, bore a hole just above where the insect is suspected to be, and put in salt which prevents its progress. About other details I can only quote the saying common in our parts of the country that, "Trees do not thrive unless you walk and talk among them."

There are many so-called varieties, but as far as I know there are only four chief varieties, distinguished from the colour of the fruit. They are:—red, green, white, and rosy. Of these the last is very rare.

The Red variety has following qualities. Its colour is red and it is the largest of all the varieties. It gives a very high percentage of oil, its shell is very thin, and its kernel is very thick and sweet. In short it is the best variety of all for almost all purposes. A tree of this variety bears on an average twenty-five to thirty fruits per year. The other three varieties are almost of the same quality, but decidedly inferior to the red type. The green and the white are found each in two forms—one short or round and the other long. Here the long variety is better than the round one in that it is sweeter, and both shell and kernel are thicker than in the round form, while it also yields a larger percentage of oil. These varieties bear about fifty to sixty fruits every year.

There is one more sweet variety called "मोह". Its peculiarity is *that its kernel dissolves in the month like sugar, and never seems to* leave any residue; some say that it is not a different variety, and I am also inclined to the same opinion; this quality appears to be due to special treatment of the tree; and even the tree supposed to be of "मोह" *is not always true to the type; fruits borne only on the* southern side of the tree, have those peculiar qualities. Why this is the case is not known.

A cocoanut tree is of value in every part to the people of the Konkan. From top to bottom everything is used.

Its main root or base is used for making a pot for the drum called नगारा; or when the tree dies young, it is used as a pot for ओकती, a small hand water-lift.

The wood of the trunk is used for various purposes. When small it forms the beam "इसाड" of a plough, or a small beam for a house. When large it forms house posts, or when cut longitudinally into halves, it forms open pipes. If none of these uses are possible, at least it forms excellent fuel.

The leaves are used *to cover the roof; the smaller mid-ribs form* brooms for cleaning. The base of the thick mid-rib is used as "*Sup*" for watering from shallow pools of water. The thin back of this mid-rib serves the purpose of a very strong tape for binding various things. *The shreds of the leaves is excellent material for making* baskets.

Just outside the inflorescence there is a thick, strong piece of network called विसुंद्री. It is used for torches.

The external thick covering of the fruit is cut and made into small brushes, useful for cleaning grinding stones. The thin threads on the inner side called काथ्या is used for ropes, and cushions, and it may very well be used for preparing brushes. Inside this is the seed, having a hard shell covering outside, and the white kernel inside. The shell forms excellent fuel, and its charcoal may be used in filters with advantage. It is cleaned from outside through one of its holes and then used as a "*Hooka.*" Now-a-days this shell is also used for making buttons.

When the fruit is young it contains nothing but a cool watery liquid. When drunk, it is very sweet, tasty and cooling in the hot season when it is constantly drunk by the people.

As the fruit ripens the thick kernel develops from the fluid. This kernel is used for eating as it is or mixed in sweets or as condiment. The chief product from the kernel however is its oil. There are two ways of extracting this oil.

The first is very simple; the kernel is dried, cut into slices and pressed either in a country *ghani*, or in a press. This is the usual method.

The second is as follows:—First the fresh kernel is boiled in water for a short time, it is then pounded in mortar, taken out and pressed. The milk, as this juice is called, is then boiled over a slow fire, when the oil floats on the top. It is then skimmed off and afterwards boiled by itself. This is called सुठेल, and is supposed to have some medicinal properties. It is considered as the best healing agent for a wound. Two quarts of oil may be procured from fourteen or fifteen cocoanuts. When fresh it is eaten and has an excellent flavour. In the Konkan freshly prepared oil is often used as a cheap substitute for *ghee*; and if it be not adulterated, it is very hard to distinguish it from *ghee*.

There is one more use or rather misuse of this tree, and that is the extraction of very mild alcoholic fluid called "*Madi*"

To procure "*Madi*" the spathe (पोय) is tied with strips of the young leaves, to prevent its expansion. It is cut a littl transversely from the top and beaten with the handle of the knife, this process having been continued morning and evening for five or six successive days, the under part of the spathe is taken off, so as to permit of its being gradually bent, when the "*Bhandaries*" or "Madi-extracters" attach it to a neighbouring leaf-stalk, for the purpose of keeping it in that position. After a further period of five days, an earthen pot is hung to the spathe, so as to receive the "*Madi*", that exudes, which is collected every morning and evening, and the spathe cut a little every day. The quantity collected varies much. It is usually two to three seers per day. From one spathe they get "*Madi*" day by day for one month. For six months they continue this with different spathes, and for remaining six months the tree is allowed rest. To climb a cocoanut tree is an art. A loop of rope is

passed round the legs or hands of the man and the tree, and then he ascends by jerks to his legs. The *Bhandaries* cut regular steps in the tree and avoid this bother.

The cocoanut tree begins to bear fruits after five or six years; and continues to bear for an average of fifty to sixty years, though there are trees as old as one hundred years. Generally fruits are gathered four or five times in the course of the year. An average tree yields from thirty to fifty nuts; superior varieties give less than the inferior varieties. One tree is worth annually about two to three rupees when fruits are sold. When the tree is given for "*Madi*" the same sum is obtained without any trouble. The "*Bhandari*" himself gets about fifteen to sixteen rupees of which nine rupees are taken by Government for license while he usually pays about four rupees to the owner of the tree. The balance represents his own earnings.

Melon Cultivation at Sangamner

BY

R. G. Padhye.

SANGAMNER is the head-quarter of the taluka of that name in the Ahmednagar district and it is a large centre for the growth of garden crops. Sugar-cane, lucerne, and onions are among the crops largely grown. Melons, too, are grown to a considerable extent and during the summer months, the market is always full of these fruits.

Melons include two kinds of plants. One is the ordinary melon (Bot. name *Cucumis melo*) locally called '*Khurbooj*' and the other is the water-melon (Bot. name *Citrullus vulgaris*) locally called '*Turbooj*' or '*Kalingad*'. The mode of cultivation is the same in both cases, but they are cultivated separately.

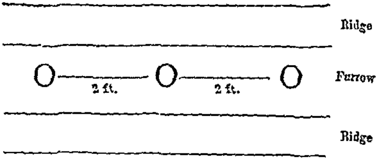
Climate :—Both plants are grown in the hot weather, provided plenty of water is available for the roots. The best varieties of melons require a dry climate as excessive moisture in the atmosphere is injurious to their successful cultivation. They are benefited, however, by a large amount of water when supplied to the roots.

Soil :—The soil chosen is of a purely sandy or gravelly nature in the beds of rivers or streams where the roots can easily absorb water from the soil. Sangamner has great advantage in having two rivers, one of which has flowing water throughout the whole year. There are large flat beds here and a site is chosen where water is constantly available for the plants. There is no necessity of artificial irrigation, as the plants get continuous water at a small depth in the soil. Watering, in fact, is not practised at all.

Manure :—A large quantity of manure is required as the sandy soil chosen contains practically no plant food. Here the manure is given three times during the period intervening between sowing and flowering. Firstly it is given at the time of sowing, secondly at the time when the plants bear five or six leaves and thirdly and lastly at the time when the plants begin to produce flower buds. The manure given here is a sort of a mixed manure, mainly composed of cowdung, sheep dung, earth, street sweepings, etc. Simple farmyard manure is supposed to be too strong for use.

Preparation of the soil :—The soil is selected and made ready in the month of December. If moisture be at a great depth, sand is taken out and the soil is made shallow in order that water may be easily accessible to the plants. The land is divided into ridges by the country hand implement called '*Khore*' at a distance of about two feet and sand in the middle of the furrow is removed by means of the *khore* and is collected at a distance of two feet in the furrow in order to make a raised bank for sowing seeds. This is better illustrated in the figure No. 1. The beds are then made as required.

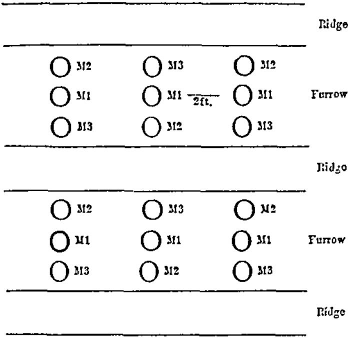
Figure No. 1



O—Raised seat of Sand for sowing seeds.

Propagation is always done by seeds. Seeds are sown at the time of '*Sankrant*' (which always falls in the middle of January). Those sown before '*Sankrant*' are said to yield greater outturn, while those sown later always fail to compete with the first in point of yield. Five or six seeds are sown in each raised seat shown in the figure No. 1 and covered with a little manure and sand. At the same time a little manure is given on each side of the raised seat. After about eight to ten days the seeds germinate and when they grow sufficiently high to bear five or six leaves, only two plants are kept and the others are uprooted. At this time about half a basket of mixed manure is given to each plant on one side towards the ridge but alternately in the same furrow and is covered with sand from that ridge. The following figure illustrate how manure is supplied.

Figure No. 2



○—Site or position of the plant.

M 1—Position of 1st manure.

M 2— ,, ,, 2nd ,,

M 3— ,, ,, 3rd and last manure.

When the plant begins to bear flower buds, the same amount of manure as given at the second time is given opposite to the place M 2. This is shown by M 3. This manure is covered with sand from the nearest ridge. At this stage all the ridges break down and the field becomes level.

Pruning is not practised here. The reason given is that the plant gets more branches and with larger number of fruits the size of the fruit becomes smaller. Where it is done, it is only done until the plant gets a dozen branches, and these give at least twelve fruits. Here the plant yields three or four fruits at the most, the effect being that they grow bigger in size.

Fruits:—The *khurbooj* begins to bear fruits in the third month and the *Turbooj* (water melon) in the fourth month. The signs of ripeness vary with the variety. In the *khurbooj* a rich perfume and a soft feel are the tests to ascertain the ripeness of the fruit; but the most sure test is to handle the fruit which at once detaches itself from the plant if it be ripe. The stalk becomes dry and hence easily separates. It is difficult to ascertain the ripeness of the water-melon which experts alone can do. They tap the fruit by the finger and judge the ripeness by the sound it produces.

The fruits are succulent and edible. The sweetness varies much with the variety. In the case of *khurbooj* the central portion is hollow and this hollow contains the seeds.

Varieties:—There are numerous varieties of melons. It is said that they do not breed true to the character of the fruit from which the seed is taken as cross fertilization takes place. I will mention only a few and common types.

There are two kinds of *Khurbooj*, both differing in fruit. In the one, the inside portion is green and in the other it is brown. The former is very sweet in taste and is much superior to the latter which is not so sweet.

In the case of *Turbooj* there are three varieties known here as follows:—

1. One giving fruit of black colour.
2. do. do. white ,,
3. do. do. ,, ,, with black lines on it.

In the first the inside flesh is blood red in colour but the fruit is not very sweet and hence is considered inferior. In the second, the flesh is not so red. It is very sweet and contains *very small* red seeds. In this there is also one variety containing black seed, resembling it in every other point. The third is also of sweet taste.

Insect pests are very rare. I did not see any pest as my observation was confined only to the last year, but the cultivators of this place have seen pests, for instance an insect attacking the fruit. Cloudy weather causes all the leaves to shrivel up and thus totally destroys the crop. There seems to be a fungus disease on the leaves as white dots are present on them; but this does not do any serious damage.

In conclusion, melons require a hot dry climate, a soil of sandy nature with a continuous supply of water and a large amount of old well-decayed manure. Under these conditions they do best. I could not ascertain the cost of cultivation as the area here is not measured but I learnt from a cultivator that with an outlay of Rs. 25/- a cultivator gets Rs. 50/- net profit. It thus seems that this cultivation is a very profitable one.

Betel nut Cultivation in Assam

BY

Naresh Das.

—:0:—

A PAPER on the above subject was read by me before the Agricultural Association at the Poona Agricultural College in one of its sittings in the present session. The President, Dr. Mann, in course of his speech, observed that I should send it for publication as a supplement to the same subject ably dealt with by Mr. F. H. Ahmed in No. 4, Vol. II of this Magazine.

In sending it for publication I would say only this that the methods of cultivation of this very important crop practised in different parts of Assam although they agree in general, are slightly different in different localities and that I would confine myself to the description of the method or methods practised in the locality I represent, I mean Lower Assam. I would also request the readers to refer to the said number of this Magazine in order that they may understand the climatological and the geological conditions of Assam as a whole.

Although it deserves to be cultivated on a great commercial scale, it is, in no part of the province, cultivated as such except chiefly for home consumption.

Preparation of Land :—The preliminary preparation of the land consists in clearing off the jungle, and then, growing *aus* paddy on it for two or three years. This practice of growing *aus* paddy completely clears off weeds from the land. The soil chosen is a sandy loam and situated high above any likelihood of inundation.

Next, plantains are grown on it in regular order at a distance of eight cubits each way. These keep the soil particles in finely divided condition and insure shade for betel nut seedlings to be transplanted there later on. And all along the boundary of the garden a big trench, usually three feet wide and about the same in depth, is dug, the earth excavated being thrown inside the garden in the form of a raised line of earth along the trench.

On this raised line of earth bamboo cuttings together with those of *Basak* (*Adhatoda vasica*) are planted. The latter, when full grown, are used for fences.

Seed Selection :—The selection of seed is done in the field. The earlier bunches of nuts are not selected for seed. The common belief is that the bunches must be washed down by the *Ambubachi* rain, that is to say, rain falling in the period of twelve days from the 14th of June. So the later bunches of nuts are always used, and nuts which have just begun to assume a yellow colour are selected and sown.

A shady place with sufficient moisture and suitable temperature is selected as the seed bed. The upper three inches of the soil is pulverised with spades or hand-hoes called "*Khanti*." Sometimes sand, earth and ash are mixed together in the bed to bring about a suitable condition. The seeds are put horizontally, half covered with earth at a distance of six to eight inches apart and a layer of straw is spread upon them to maintain a uniform temperature. The best time for sowing is the month of September when the rainfall has almost ceased, and hence there is no fear of the young seedlings being killed by water logging.

Transplantation :—The most common method is to transplant once. But in some gardens seedlings are transplanted repeatedly five or six times. In the latter case the palms bear fruit when they are only a few feet high. The method of transplanting is almost the same every where in Assam. A distance of eight feet is kept between the plants in hopes of planting another crop of palms subsequently, in between them, when the old crop has grown old enough. After transplanting, the holes are not filled up completely but a circular margin of three inches wide and one and a half inches deep is kept around the trunk, unearthed for sometime so that it may hold rain water. But when there is plenty of rain, it is forthwith covered with cowdung, ash and earth.

When the seedlings firmly fix themselves into the soil, the land round about is frequently weeded and the refuse obtained together with fresh cowdung are applied to the trunks. Almost in every garden betel vines are allowed to grow around the palms.

After-treatment :—Generally no watering is practised. But in hilly dry places watering is occasionally practised in the young stages of the seedlings. It is done in a most primitive way, hand-watering from a pitcher being the method employed.

Water-logging is most injurious to the palms. So the very first care, on the part of the gardener, is to make suitable arrangements for draining the excess of water, coming as rain, out of the garden. A

convenient number of drains, both lengthwise and crosswise, according to the natural slope of the ground, are laid in the gardens and are made to enter the trench which runs round the border.

On the raised line of earth along the trench, mentioned above, which is known as *Pagar*, bamboo cuttings are planted almost on all sides of the garden. To protect the garden against the intrusion of animals some fencing plants such as *Basok* (*Adhatoda vasica*), *Mandar* (*Erythrina indica*) and other similar plants, which can be propagated by cutting and which give a luxuriant growth in a short time, are planted which, when wooden stakes are tied on them, make a good and durable fence.

Diseases of the Palms :—The palms as well as the nuts are subject to many diseases, and insect pests. I intend to enumerate only those which have not been dealt with by Mr. F. H. Ahmed.

I. *Lichens*—These are exceedingly common on the palms. It is doubtful, however, whether they really do any injury to the palms.

II. *Tepa disease* :—This disease is very common in Assam. When affected by this disease some three or more internodes just below the leaves, become extremely short, one inch being the length in extreme cases. The palm at that part becomes constricted, and the part just above it exceedingly swollen. The leaves become shorter and shorter and present an unhealthy look. Subsequently, when the disease is much advanced, they turn yellow and the middle leaf dries. After a short time, the whole crown is broken down at the point immediately below the leaves. When the swelling portion is scratched with sharp knife, some two or three sheaths deep, on several places round about it, a gelatinous gumlike substance exudes from the scratches, and in fifty out of one hundred cases, this cures the plant leaving the constricted part as such for ever. Before bearing, the plants are liable to this disease. Before this a plant may be affected as many as four times. About ten per cent of plants have been seen in our garden to be affected by this disease.

III. Another serious disease affecting a part of my district for twenty years or so has been reported to me this time by men of undoubted honour and position and consequently reliability, holding large gardens. But unfortunately none could furnish me with information sufficient to diagnose it. The whole information, when condensed, is simply this. At first one or two leaves of a small number of palms turn yellow; subsequently the middle leaf dries up and can be pulled out; later on the whole crown dries up and falls drown leaving the crownless palm erect for a long time.

And in a few cases the trunks also fall down. A garden once attacked will hardly have 10 % of plants unaffected.

IV. *Fulla disease*:—This is a very common disease doing a great deal of damage to the fruits. It first attacks the substance and then the embryo. The substance becomes soft, white and less juicy with prominent red stripes and is correlated with the change from the usual colour into red. The fruit also cracks at the bottom. The nuts thus affected are not selected for seed. They do not keep for a long time when preserved, nor do they germinate when sown and are more astringent than the ordinary ones. Nobody knows at what time and at what stage of its growth the fruit is attacked by this disease nor does anybody know the true nature of the disease. There is nothing, in the cultivation of this crop, that demands a more serious investigation than this disease. The common people ascribe it to various causes. Some say that the strong gusts of wind, blowing at the time when the sap has formed inside the young fruits, thus shaking the bunch to an undesirable extent, produce this disease. Some, on the other hand, hold that the scarcity of rainfall at the time when sap is formed within the nuts, is its cause.

Harvest:—The nuts are harvested in two instalments, and the time for harvesting is different with different varieties. In our district there are grown two varieties, one Assamese, and the other Bengali.

Bengali variety:—The nuts of this variety are small, round and have more intoxicating and astringent properties. Its nut matures when the Assamese variety begins to bear fruit. So it is a very pleasant substitute for the people in Assam who consume raw nuts. It is chiefly grown for home consumption and that too in a smaller measure.

Assamese variety:—This is the dominant variety and commands a good market. The nuts are much bigger, more elongated, and sweet. The nuts are harvested in two instalments—one in the months of April and May and the other in the months of July and August.

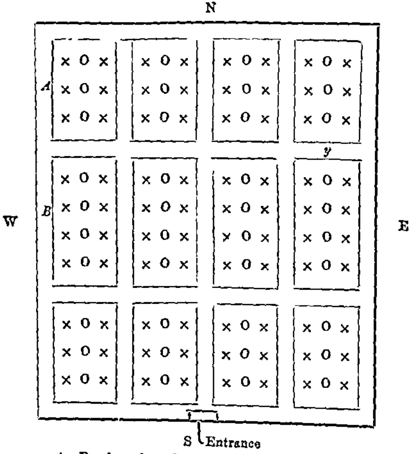
There is another variety in Lower Assam known as "*rutu*", a sample of which has been kept in the College laboratory, Poona. It is curiously small and simply grown for medicinal purposes. The palms are thin and short and grow in clumps. They keep the same time, as regards ripening fruit, with the Assamese variety.

Preservation of nuts:—In Assam the nuts are used raw and hence sold also raw. But the preserved nuts which are commonly known as "*Maja Tamul*" are less astringent and sweeter in taste and hence command a higher market than fresh ones. The preservation is done in a very simple and inexpensive way. Pits are dug in the ground, in

the open air, the capacities of which being determined by the amount to be put in, sheaths of the palm leaves are spread around the pit inside and nuts are put in and covered with the sheaths, and upon them earth. The nuts of the later bunches are usually selected. The maximum time allowed for keeping the nuts in the earth is six months. Beyond that period the nuts will begin to rot.

Income and Expenditure:—As regards the expenses of gardening I could not procure any elaborate table. But it is surely much less than that set forth in the article by Mr. F. H. Ahmed previously quoted.

Outturn depends upon the age of the palm and size of the nuts. Very old palms give fewer bunches, and the bigger the size of the nuts the scantier is the production. The money value of the produce also varies according to the market fluctuation. On an average one palm of medium age may be said to yield nuts worth Rs. 3.



A—Bamboo planted. *B*—Trench. *Y*—Drains.
O—Plantain to be removed. *X*—Betel nut.

Note on the Amrit Mahal Department of Mysore

BY

J. B. Knight, M. Sc.,

Professor of Agriculture.

(The following notes on the organisation of the famous Amrit Mahal Department in Mysore, which has the control of the Amrit Mahal Cattle kept by the Mysore Durbar has been written after a recent visit to Mysore. They will be, we think, of special interest.—Eds.)

THE Department consists of a Superintendent and six Darogas. Each Daroga has a clerk. The Darogas are situated at the following ranges.—Chellakere, Holakere, Birur, Arsikere, Tumkur, Hunsur. The Birur range contains 8000 acres much of which is hilly and stony.

The total strength of cattle is about 11000. These are divided into thirteen herds and usually three herds are kept at a range. The herds are composed of from four to six hundred animals and are each under the charge of a Scirvegar assisted by two Mundals and twelve to sixteen graziers. This staff is supplied with a cook and food, two pack bullocks being allowed to them for conveying their baggage, while they also have a small route tent. They are allowed to milk the cows for their own supply of milk.

The cattle are never sheltered in any way and are never tied or confined in a pen. They are grazed in groups of one hundred or so, made up according to their age and condition but all come together each night. The very young calves are kept in a thorn enclosure at night. The bull calves for each group of one hundred animals are taken when young, castrated, and carefully trained to come when called, to lie down when a blanket is spread, etc. These are called leaders and the cattle all follow them. The herds are moved about from pasture to pasture as the grass and demands of the cattle require, usually returning to the same pastures twice or thrice a year according to the rainfall and quality of the pasture. Certain ranges which are moist are kept for hot season grazing, and herds are often moved from range to range according to their condition and the food available.

A certain amount of hay is cut on some ranges for feeding in the fair season in times of shortness in the pastures but no concentrated foods are ever given.

The stud bulls are kept with each group of one hundred cows. These are changed from herd to herd often enough to prevent breeding of nearly related animals. The calves suckle from six months to one year. Cows do not usually conceive till the calves are weaned. Heifers are rarely sold but are bred at between five and seven years of age and continue to breed till they are twenty years old. The bulls are sold to Government and the public at four years of age at from Rs. 200 to 400 per pair, while specially good ones may bring even more. The young bulls are very difficult to rope and train but once brought to the yoke they become docile. The Amrit Mahal is a long time coming to full maturity, growing often up to eight years of age. Future stud bulls for the Amrit Mahal Department are selected when one year old. A second selection is made for supplying breeding bulls to District Boards and others. The others are castrated. The cows too old for breeding are kept in separate groups.

All calves are branded within a month of birth. The system of branding is as below:—

(1) On the shoulder the herd number.

(2) On the thigh the year and in males the quarter number.

(3) On the rump the serial number of the year in the case of females.

Records are kept showing birth and parentage of each animal.

During my recent visit to Mysore, I had the opportunity of seeing groups of animals from herds Nos. 14 and 2.

The animals on the whole are very uniform in shape. Their bones are fine and their limbs clean cut and neat in appearance with no loose skin. The heads of the bulls seen were much finer than the so called Khillari found in Southern Satara. They do not have the heavy overhanging brow so common among the Maswad Khillaris. In the cows the horns are slender and arise near together and run backwards nearly parallel or slightly diverging and at the points form a graceful

curve forwards. I did not see any old bullocks but I was told that their horns should resemble those of the cows. There is no loose skin around the sheath in the bullocks and very little in the dewlap.

The principal colour is squirrel grey shading to white; in some individuals the grey is blotched with white especially about the face.

The cows were larger than I expected. They are considerably taller than most of the cows of the Bombay Presidency except Gujerat and only about a hand shorter than those.

The cattle were quite tame allowing their herders to fondle them nor did they seem afraid of me although, being a stranger, they did not allow me to come near enough to touch them.

Notes on the Cattle in the Tellingana of the Nizam's Dominions

BY

B. Govind Rao, B. Ag.

THE following notes of some of my observations during a recent tour may be of interest, because the Nizam's Dominions lie aside from the usual track of agricultural observers. That State possesses no agricultural department, and, therefore, though it contains some of the richest tracts in the centre of the Indian Peninsula, these are little known.

The observations were made in the course of a journey to Yelandlapabad, the site of the well-known Singareni coal mines. In order to reach this spot, a railway journey was required through a portion of the Warangal district, covered with some of the densest forests in the State. So wild is this district that the villages seem little else than groups of huts barred all round with a thick hedge of thorny bamboos—here a common feature of the jungle. The sole occupation of the people here is cattle breeding, and many of them live on raw roots called Sannagadda (सन्नागड्डा) and Chinnagadda (चिन्नागड्डा). The agricultural condition is exceedingly backward, and few crops are grown, but, on the other hand, the cattle are excellent.

These cattle are nearly all oxen, the number of buffaloes being almost negligible. Though no regular principles are observed, and no definite purpose is kept in view in the breeding of these animals, yet

the method adopted is similar to that of the Rabaris in Gujerat. The animals are penned at night in open stalls, and are let out in the morning to pasture, which on account of ample rainfall and the well-drained light soil, gives abundance of sweet grass. The cows and bulls are herded separately while grazing, the young of both the sexes being allowed to follow their dams. The cows which are poor milkers are not milked, being left to suckle the calves. Thus, the animals which most probably belong to the Nellore breed or are of a breed allied to it for reasons given below, live in an almost wild condition, and are consequently well built, healthy and strong, inheriting at the same time an extreme timidity of strangers. The reasons for my inference as to the breed are the points of resemblance in the eyes, ears, horns and the general white or iron-grey colour of the body, as well as the fact that the strip of country adjoins the Godavari district.

From these breeding centres young heifers and bulls when about a year and a half, or two years old, are taken in large numbers for sale into other districts. This sale is generally conducted on the occasion of certain Jatras, Melas or Urus held in some towns, as Bhongir, Khammam and Jedikal. The animals so purchased are mixed freely with the previously existing ones in the country, and bred together indiscriminately. The result naturally is that the cattle have become very mixed and much inferior. It is, however, gratifying to note that the breed, as it exists in these Warangal jungles owing to want of good communications, is yet, as a rule, uniform. The prevailing colour is white, there being also many individuals of iron grey colour, white on the neck, with a few red, and some few black animals.

The following are the characteristics of the Telingana working cattle :—

Face small, narrow and somewhat dishy. Horns short and blunt, taking first an outward curve and then going inward a little up and there stop; or they grow outward only a short distance, terminating in a blunt point. Eyes and muzzle are black. Eyes are placed on the sides of the forehead. There is not much development of dewlap and the skin about the sheath. Tail long with a bushy switch. Hump short. Neck thin and long. Chest rather deep than wide. Back level but loins narrow. Legs thin. The animals, on the whole, are of average dimensions, with a compact frame; and are soft-footed, suited to the tract, the greater portion of which is all light soil.

I presume that, if the common causes of deterioration of a breed, which need not be specially mentioned here, be avoided and then a regular system of grading be adopted with the nicely bred cattle of the forest villages I have above mentioned, the present progeny of Telingana working animals will be raised to a higher standard and will, in course of time, attain the larger size and the well-proportioned limbs of their forest friends.

✓Value and Proper Conservation of Cattle Excrement

BY

V. G. Gokhale, L. Ag.,

Superintendent, Agricultural College Farm, Poona.

THE question of sufficient supply of manure is becoming more and more serious and most progressive cultivators are looking out for sources from which they can meet the increasing demand.

This article gives the results of the experiments carried out on the Agricultural College Farm in some of the lines in which the cattle excrement can be saved and utilised in an efficient and cheap manner.

The cattle excrement which can be turned to manure is of two kinds—the solid and the liquid, or the dung and urine of cattle.

Observations have been made on both these substances in the experiments on the College Farm.

For this purpose two pairs of ordinary-sized Deccan bullocks have been kept under observation. Their names and average weights are given below :—

I.	Lavanga ...	675 lbs.
	Jambhala ...	703 lbs.
II.	Gulya ...	781 lbs.
	Phowja ...	725 lbs.

DUNG.

The experiment in this line consisted of finding out how much manure a cultivator can make by carefully storing all the solid excreta only which he can collect, in an ordinary pit made in the medium black soil.

With this intention the solid excreta,—dung,—from each of the above two pairs were separately weighed daily and stored in a pit together for both the pairs. The pit was six feet in diameter and three feet deep. The experiment was commenced from 2nd September 1910 and the same pit received the quantities for four months.

The following table gives the quantities obtained month by month for each pair separately, and the daily average :—

Period.	I. Lavanga—Jambhala.		II. Gulya—Phowja.	
	Quantity per month.	Daily average.	Quantity per month.	Daily average.
	lbs.	lbs.	lbs.	lbs.
2—30 September ...	610	21	692	23·9
1—31 October ...	793	25·6	877	28·2
1—30 November ...	800	26·6	903	30·1
1st December to (3rd January 1911). ...	803	23·6	856	25·2
Total ...	3006	24·2	3328	26·8

It should be noted that the pairs were in the cattle shed only for fourteen hours each day, except a few rainy days, which in the above period were only ten. This is exactly the condition which can be expected with a cultivator.

No litter, straw, waste fodder, water or any other substance was added.

The pit was emptied out on the last day of the period (January 4th, 1911). It weighed 4846 lbs. when taken out. The whole stuff except the top-layer of six inches was thoroughly rotten and in an excellent condition to be applied to the field. It was therefore immediately spread in one of the plots of a series specially set apart for testing and comparing the various methods under experiment, and ploughed in.

The observations were continued and the emptied pit used again for storing the dung for another period of the next five months. The figures for these appear in the following statement :—

Period.		I. *Lavanga—Jambhala.		II. Gulya—Phowja.	
		Quantity per month.	Daily average.	Quantity per month.	Daily average.
		lbs.	lbs.	lbs.	lbs.
4—31 January	...	509	18·2	569	20·3
1—28 February	...	446	15·9	644	23·0
1—31 March	...	658	21·2	716	23·1
1—30 April	...	364	12·1	641	21·3
1—20 May	...	300	15·0	374	18·7
Total	..	2277	16·5	2944	21·3

The contents were taken out of the pit on 21st May, when it weighed 1902 lbs. It was also observed that the dung was dried into cakes except the bottom layer of one foot, showing that in hot weather the natural moisture in the dung was not sufficient for the proper decay of the dung and addition of water might have helped the decomposition.

This was applied immediately after removal to another plot in the series.

It can be deduced from the above figures taken together that 6748 lbs. of good manure ready for application can be obtained from two pairs in nine months. This would mean about eight cartloads, for a cartful of manure round about Poona weighs 800 lbs. This will come roughly to 6 carts per pair per annum.

URINE.

No attention has ever been seen to be given by any cultivator to utilising the cattle urine for manure, in the Bombay Presidency, though the substance is certainly more valuable than the dung.

* Note :—The quantities of the dung in the case of first pair is very low in the months of February and April, which is due to one of the bullocks (Jambhala) being sick and in the hospital, and consequently not under observation from 22nd to 28th February and 1st to 6th April.

In order therefore to demonstrate its value, and at the same time to compare it with dung, the following methods of conservation have been adopted.

1. Collecting the urine as such through a drain over the sloping paved floor of the cattle shed and applying it to an irrigated crop through the irrigation water.

2. Absorbing the urine in some absorbing material spread under the feet of the cattle.

To demonstrate the first system, two plots each four gunthas* were allotted. These were transplanted with onions in the rabi season of 1910-11 on 1st February 1911, and had to be irrigated. One plot did not receive any manure but the other received 200 lbs. of urine at each irrigation (at the interval of 10 days). The urine was stored in an earthern jar of 20 gallons capacity with a small hole at the side of the bottom, which was made of a size calculated to discharge the whole contents gradually during the time it usually takes to irrigate a four guntha plot (which is nearly one hour). This jar was kept just near the plot over the main water-channel, which supplied the water to the plot.

In all 14 waterings were given and the results of outturn per acre are given below :—

Treatment.	Outturn of onions per acre.	Estimated value.
	lbs.	Rs. a. p.
Urine given as described above.	25880	161 12 0
No manure	21530	134 8 0
Gain due to urine	4350	27 4 0

The cost of collecting urine was only trifling. This system however involves the expense of having a stone paved floor which is about Rs. 25 per pair of cattle. There is no definite data as to how much urine can be obtained from a pair of Deccani bullocks. But it will not be an over-estimate if 20 lbs. be taken as the daily quantity per pair.

* A guntha is one fortieth of an acre.

This will be just sufficient for a four guntha plot to be given every 10 days. This quantity when applied to an onion crop for five months fetches a value of Rs. 2-7. At this rate the annual out-put per pair will be worth Rs. 6. This should be able to pay for the extra cost of pavement within four years, after which period it will be a net gain.

The second system consists in spreading some absorbent material under the feet of cattle as litter, which will absorb the urine as it is dropped and will retain the manurial ingredients.

The articles that can be advantageously used are dry friable pulverised earth or sand. The red soil from thin sloping soils, or the alluvium or sand from stream banks may be used. Further, any other waste product which has a sufficient absorbent power such as groundnut shells, safflower shells, paddy husk, dried leaves, refuse fodder or weeds may be employed.

In the methods tested and demonstrated on the College Farm, (a) river earth and (b) the groundnut shells were used.

(a) *The dry earth system* :—The first of the two pairs mentioned in the beginning was set apart for this experiment. Dry earth was obtained from the river side from behind the agricultural quarters and a six inch layer spread under the feet of the above pair on 24th July 1910. It weighed 1891 lbs. at the time of spreading. It was also analysed before use and the composition was as given below :—

Nitrogen	0·13 per cent.
Phosphoric acid	0·22 ,, ,,
Potash	0·15 ,, ,,

The dung was removed daily and the wet patches stirred and made dry bringing the dry portions from below and from the sides. This was continued for five months and ten days on the same earth. After the above period it was removed,—on 3rd January 1911. It weighed 1550 lbs. at this time. A representative sample was again sent for analysis, which was reported to contain :—

Nitrogen	0·48 per cent.
Phosphoric acid	0·69 ,, ,,
Potash	0·82 ,, ,,

The decrease in the weight is due to some quantity of earth being necessarily and inseparably stuck to the dung and removed to the pit along with the latter.

It was observed that during the above period there was no objectionable smell or any other appearance of insanitary conditions in the place, nor was the health of cattle affected.

It would thus be seen that the following quantities of plantfoods were actually conserved from the urine by the dry earth system during five months.

Plant-food element.	Before absorption 1891 lbs.	After absorption 1550 lbs.	Gain.
	lbs.	lbs.	lbs.
Nitrogen ...	2·45	7·44	4·99
Phosphoric acid ...	4·16	10·69	6·53
Potash	2·83	12·71	9·88

The quantity removed from the cattle shed was on the same day applied to a third plot of the series already mentioned.

Another lot of fresh dry earth as large in weight as on the first occasion was again spread on the 4th January, removed on 23rd June and applied to another plot in the same series as a duplicate. This weighed 1567 lbs. at the time of removal.

(b) *Groundnut shells*:—These are obtainable in very large quantities in groundnut growing tracts but have never been used as manure, the reason told being that they take a considerable time to decay. It was thought however that if they are used as an absorbent of urine, not only can the urine be conserved, but the intrinsic manurial value of the shells themselves can be utilised. The manurial value of this material can be very well judged from the following figures of its composition:—

Nitrogen	... 0·98	per cent.
Phosphoric acid ...	... 0·28	,, ,,
Potash	... 0·35	,, ,,

A six inch layer of this material was therefore spread under the feet of the second pair on 24th July 1910. The dung was removed daily and the litter stirred as in the case of the dung. It was noticed that the stuff was used up in about a month and had a tendency to become foul. It was therefore removed on 2nd September 1910, and

thrown in a pit for decay. Its weight to start with was 192 lbs. and this at the time of removal was 391 lbs. It was also noticed that the stuff was rendered fine by trampling of the bullocks. Representative sample was analysed at the time of removal and was reported to have the following compositions.—

Nitrogen	1·47 per cent.
Phosphoric acid	0·28 „ „
Potash	2·08 „ „

From the above data it can be deduced that the following quantities of plantfoods can be conserved in forty days by the groundnut shells :—

Plant-food element.	Before absorption (192) lbs.	After absorption (391 lbs.)	Gain.
	lbs.	lbs.	lbs.
Nitrogen	1·90	5·74	3·84
Phosphoric acid.	0·53	1·09	0·56
Potash	0 07	8·13	7·36

The litter of groundnut shells was removed about every month, and the weights obtained recorded at each removal. They have been shown in the following statement :—

Date of spreading.	Weight at the time of spreading.	Date of removal.	Weight at the time of removal.
	lbs.		lbs.
24- 7-10 ...	192	2- 9-10 ...	391
2- 9-10 ...	192	4-10-10 ...	395
4-10-10 ...	192	1-11-10 ...	245
1-11-10 ...	192	2-12-10 ...	257
2-12-10 ...	192	1- 2-11 ...	204
1- 2-11 ...	192	2- 3-11 ...	297
2- 3-11 ...	192	2- 4-11 ...	245
2- 4-11 ..	192	4- 5-11 ...	235
4- 5-11 ...	192	6- 6-11 ...	215
Total......	1728		2484

All these were stored in the same pit for the above period of ten and a half months. A layer of earth was occasionally spread over to compact the mass and exclude it from the heat of the sun.

The whole quantity was then taken out of the pit, when it weighed 1490 lbs. (including added earth). It was noticed that the whole mass was thoroughly rotten except two or three layers at the top. It was immediately applied to a plot in the same series as before.

By comparing the figures of plant foods conserved by the two methods, dry earth and groundnut shells, it is seen that the groundnut shells have absorbed and retained much better than the dry earth, taking equal periods for both. The dry earth has conserved only twenty-five per cent of the Nitrogen and Potash in a period of five months of that by the successive doses of groundnut shells during the same period. To what this may be due is not yet understood. No loss of Nitrogen in the form of Ammonia was suspected at the daily visits to the place. Supposing this however to have occurred, or the Nitrogen to have been lost by denitrification, the deficit in Potash is at least unaccountable. It is not also understood whence the dry earth got so much Phosphoric acid more than the groundnut shells.

The series of plots which has been set apart for testing and demonstrating the effects of various methods received the manures as stated above, before sowing. *Varadi* cotton has been sown on all these plots in June. The following deductions can be drawn from the present (15th September) appearance of the crop.

1. The first plot of dung, two plots of dry earth, and that of groundnut shells are a decided advantage over the unmanured plot.

2. The second plot of dung (*i. e.* the one receiving the quantity from the dry weather months--January to May 1911) is a little better than the unmanured one, but nothing like the above. The dried dung though ploughed in had not sufficient moisture or time for decay and it is being brought up at the surface by the inter-tillage implements.

3. The dry earth plot receiving the quantity from one pair from August to December 1910, is as good as the dung from two pairs for the same period as far as the present appearance can tell.

4. The groundnut shells is at present the best of the lot, but it represents the urine conserved for 10½ months as against 5 months of the remaining plots.

From what has been said about it can be clearly seen that the urine is at least as valuable as the dung of cattle for the same period and that it is possible to conserve it in a very simple, inexpensive, and efficient manner. It is thus possible to double the supply of manure in the resources already existing.

The Question of the supply of good fodder in the North Konkan.

BY

K. V. Joshi, B. Ag.

THE question of the supply for fodder is one of the difficulties, brought forward by the people of Konkan, whenever dealing with the up-keep and maintenance of cattle. Now-a-days the condition of the cattle is said to be much lower than formerly. Cattle often die during the months of June and July—when their services are very much required for ploughing—due to not getting nearly enough food during the previous hot weather.

This is the more important as it is evident in India that cattle form the right hand of a cultivator. Hence in trying to consider agricultural improvement in a tract, the question of maintaining the condition of cattle becomes one of the most important of these considered. If this object can be secured by extra labour or by the expenditure of money, every good cultivator will take to the former, as the condition of the cultivators in the Konkan is extremely poor. They are asked to spend anything in cash, they are unable to do it. Hence if the question is tackled from the manual labour point in view, that is to say, that the cultivator need not spend in cash but can gain the object simply by his and family's work and labour, it is much more likely that the desired object will be attained.

Aside from the question of good housing and clean water for drinking, a full supply of some good fodder is by far the most important point in the up-keep of cattle. In the Konkan generally rice straw is the only stuff used as fodder. Grass is used but to a limited extent, as it is either exported to Bombay or used for burning 'Rab'. No con-

centrated food or fodder is given by the average cultivator to the cattle. Those cultivators who, side by side with agriculture, do the business of carting, give about two pounds of oil-cake per bullock per day till March, after which the Bhusa of *Wal* (*Dolichos lablal*) a mixture of the pods and leaves is given. But this only the working pair gets. The rest lives on grazing if available by day and one bundle of four pounds of rice straw per head by night. Rice straw is an extremely poor fodder and even of that the cattle do not get sufficient. In spite of the practice of not growing any fodder crop in Konkan, the only one fodder that of straw, is not available for the cattle in the full quantity which is grown in the fields The cultivator himself is a partner in this, because, he utilises a large quantity of it for thatching his house every year.

Special attention in feeding is given by well-to-do cultivators in the working season. In the Konkan the real help of plough cattle is required from the beginning of June to the middle of August—two and a half months continuously—without any day's rest, for sowing, ploughing and transplanting. After this generally the remaining part of the year is a rest to the cattle. Where Rabi crops of *Wal* and gram are taken, the plough cattle have to work for a month or so in November. But the percentage of Rabi crops is small in Konkan, as it depends upon the moisture-holding capacity of the land and the nuisance of wild and stray cattle.

From the middle of August the new green grass becomes available for the cattle to graze but at this time it is very small in growth. From September to December (both inclusive) good grazing is available and consequently the condition of the cattle is improved in this season. It is really in this season that the development of the body of young ones takes place. In this season the supply of drinking water also is good and sufficient. In fact of the twelve months of a year, these four months are the most favourable for the cattle.

By January the grass is cut and either exported to Bombay or stored for 'Rab'. Consequently grazing becomes poorer until at last no grazing is available from February to August. To add to this inadequate supply of fodder, the supply of drinking water becomes very short so much so that in several villages cattle are required to be taken to a very long distance for watering and in some cases dirty water is given to them.

Both these difficulties have a marked effect on the condition of the cattle. The good appearance of the cattle of December is day by day gradually lost, till at last many of them are reduced to a mere skeleton in June and July. This is found in the case of average cattle both males and females, young and old, and is by no means an exaggeration.

What is required to improve this condition is a good supply of some kind of good fodder and the following are the suggestions to remedy this:—

The other day while travelling from Surat to Bombay, I saw the crop of 'Tag' (Sann) in several fields between the Bulsar and Gholwad stations, growing very luxuriently. More than half of this tract is in the Thana district, that is, it is part of the North Konkan. There seemed to be a large cultivation of this crop in this tract and it occurred to my mind that this can be utilised as a good fodder for the cattle for about a month and a half. I wondered as to why cultivators, in the other parts of the Thana and Kolaba districts, should not take to this crop.

The difficulty that they might raise is, that sufficient moisture is not available in their soils. But if this crop is sown chiefly with the fodder idea in view, any growth of the crop from one foot to three feet is welcome. Sann, however, becomes fibrous afterwards and then the cattle will not eat it. It can only be fed when upto one month's growth. A small quantity of it will keep the cattle fresh. Moreover on inquiry I learnt, that the yield of rice after the crop of *Tag* (Sann) is decidedly increased in these tracts. Hence the advantage of growing *Tag* as a Rabi crop in all the fields is two-fold.

On inquiry the following information was collected regarding the crop:—

Tag or Sann:—This crop is largely grown between Bulsar and Gholwad stations of B. B. & C. I. Railway, the whole of Umbergaon Peta, part of Dahanu taluka, and the Daman states. It is both grown as a kharif and rabi crop, the objects being totally different in the two seasons. The kharif crop is chiefly meant for fibre while seed is the only point in view in the case of the rabi crop. The Kharif crop is taken in a large tract—Bulsar to Bassein—along sea coast, as *Tag* fibre is in great demand by the

fishermen, and fetches a good price. Moreover, as it is taken on the *Varkas* lands, in the kharif season, it does not interfere with the crop of rice. The rabi season crop is taken after rice in the rice fields and the tract where this is done is very limited. As fibre is in view, the kharif *Tag* is sown very thick—not to allow branching. The rabi is sown rather thin.

As the kharif crop is not allowed to fruit, no seed is obtained from that crop for sowing next year. Hence it is sown in the rabi season for seed. Thin sowing facilitates branching and so more seed is obtained. The surplus yield of seed is fed to cattle. They told me that no stray cattle are allowed in this tract till the rabi crops of *wal*, gram, and *Tag* are over. Hence no fencing was seen round the fields. *Tag* is also sown mixed with *wal*.

The quantity of seed sown per acre, and yield of fibre and seed per acre, could not be known definitely; but from six to eight times the seed sown is the yield of grain.

In some parts of the tract mentioned, the *Tag* plants in green condition, are given to bullocks used for carting, as fodder, but this use is very limited. In my opinion if *Tag* is sown in all the rice fields in the North Konkan throughout it will serve as a good green fodder in the months of January and half of February because, the dates of sowing *Tag* in the early and the late rice fields, will range within one month.

When *wal* is sown after rice, it should be sown very thick and thinned out afterwards little by little every day and fed to cattle.

Groundnut is a new crop introduced in the Konkan, and it was observed by me last year that if sown thick, it has a tendency to produce very much green matter and less pods than usual. If sown at a greater distance more pods and less green matter are produced. I saw last year plants three to four feet long. This if kept in a silo or treated otherwise, will be a kind of good fodder in stock,—where there is more trouble from rats etc. groundnut may be grown as a fodder crop and preserved. This may be given with advantage in the months of March, April and May. The Bhusa of *wal* is also a good food for cattle in March, April and May.

It was also observed at Panvel that *jowar* grows well on *varkas* lands and its cultivation as a fodder crop may well be introduced in the Konkan, and it will be of use in June and July if kept in stock till then.

If some substitute be found for thatching the houses of cultivators, a large quantity of straw can be made available for the cattle.

If hay be made in time, that will serve as a good food. Hay is largely exported to Bombay. They tell me that if grass is cut in flower and not allowed to fruit, the quantity of grass that one can reap next year is reduced considerably as sufficient seed does not fall on the ground. As grass is exported to Bombay, they always look to the quantity and not much to quality. Hence grass is allowed to ripen well and the seed to fall on the ground.

Whenever substitutes for *Rab* are mentioned to a cultivator, he always brings forward the difficulty of paying in cash for the manure, while he says he can burn his land simply by manual labour. In this case also the same difficulty will be put before us by the cultivator. Hence the suggestions made above are such as can be carried out simply by manual labour. In some parts the cultivators are idle in the rabi season and if they give it up and become ready for labour and work they are sure to improve the condition of their cattle without any actual out-of-pocket expenditure.

An account of the description of rice grasshoppers at Belgaum.

BY

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THE destruction done to several crops in the Deccan and Karnatak by several types of grasshopper has been increasing constantly in recent years. Of the insects which do the damage, two are the most prominent,—the Deccan or *jola* grasshopper (*Colemannia sphenarioides*) which chiefly attacks *jowar* and *bajri*, and the Belgaum rice grasshopper (*Hieroglyphus banian*) which has become a most ruinous pest in the very rich tract in which rice is cultivated near Belgaum. The work to be described in the present paper was done in an attempt to hold the latter in check.

The appearance of these Belgaum rice grasshoppers in large numbers dates from ten to fifteen years ago but was not found to cause very serious damage to rice-crops till about five to six years ago, when the attention of the revenue authorities of the place was attracted to it.

To destroy these various stomach poisons were at first tried for one or two years by spraying poisonous solutions on the chief food of these hoppers *viz*. rice-plants but no success could be achieved on account of the *torrential* rains at Belgaum washing away the poisons thus sprayed, and also on account of the cost being prohibitive. Then mechanical methods were resorted to, and the first attempts were made with a net invented by Mr. Stockholm for the rice-fields of the Central Provinces. This was far from satisfactory as it was heavy requiring nine men to drag and therefore became very unwieldy to use in the small terraced and flooded rice-beds of Belgaum.

In the year 1908, the attention of the Bombay agricultural department was directed to it. And to combat this pest they also tried various stomach poisons with no effect, but succeeded in preparing a net so as to suit very successfully the conditions of the rice lands of Belgaum out of many patterns invented and tried. The net is described below and costs only Rs. 1-12-0:—

It is a simple bag with a mouth open on the broad side. The material used is coarse gunny sacking costing about two and a half annas a yard of forty-five inches wide. The bag measures nine feet by three feet at the mouth and is forty-five inches wide. On the broader side two bamboos are tied to the lower and upper side of the mouth. A rope is sown into the hem of the mouth to afford sufficient strength.

In operation two men hold either side of the bamboos which are kept long enough to afford a good hold, and run along the field against the direction of the prevailing wind. The bag should hang loosely so that the lower bamboo may dangle on the crop. When they run this way the bag opens well and the hoppers disturbed by the bamboo jump and fall into the bag. When the end of the field is reached a man specially provided for the purpose brushes and empties the hoppers into a small bag which he carries with him.

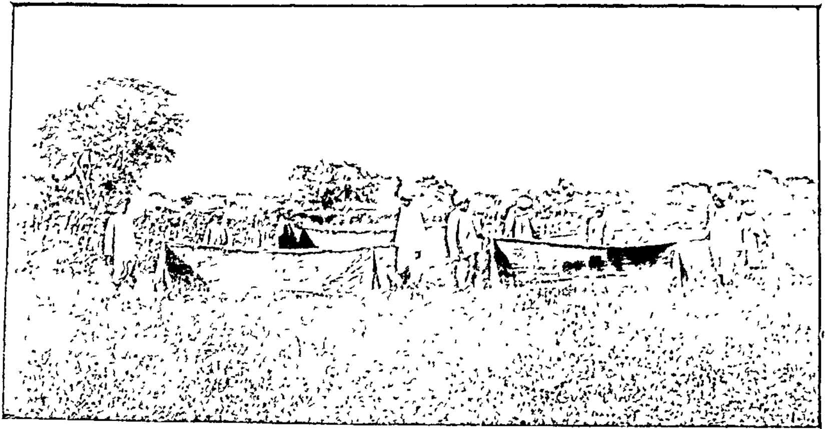
The use and effectiveness of such netting was demonstrated to the cultivators but on account of their apathy for such work they would not take to it. The Agricultural Department therefore organised

a campaign in the year 1910 with a view to remove this pest and also to convince the people of the effectiveness of the system. For this contributions were raised by the collector, and the agricultural department bore all expenses in connection with the establishment *viz.* cost of preparing bags, supervision of labour etc. The area infested was divided into four divisions of about 2,000 acres each and a batch of thirty nets was kept working in each division under the supervision of a mukadam. One batch finished an area of 40 acres and killed on an average 300 lbs. of these hoppers in one day. The work was done for full thirty days and the pest was greatly reduced and about twenty-five to thirty per cent of a full crop of paddy was obtained that year.

The same work was continued this year and in forty working days, more than 185 millions of these insects were killed at a cost of Rs. 2,854/- from an area of nearly ten thousand acres.

As a good result of the last and this year's work, the rice crops have been quite saved to the value of seventy-five per cent of a full crop and it is expected that the pest will almost disappear though the operations will have to be continued at least for one year more to annihilate it.

There are two things which I must emphasise in carrying out this method of combating the rice grasshopper. These are: (1) the adoption of the remedial measures from the first appearance of the pest and (2) co-operation. The first is important as prevention is better than cure, and the second is essential because one man may clear the hoppers from his fields but if his neighbours do not follow his good example, it is evident that there will be invasions of these insects into the cleared fields from the neighbouring uncleaned ones.



Working with nets to Catch the Rice Grass hoppers.

The "Koleroga" disease of Areca palms.

BY

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AND

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THROUGHOUT the North and South Canara districts, a serious disease known by the above name occurs in the Betelnut plantations. The name signifies, in Canarese, "rotting" which indicates the chief symptom of the disease namely, a falling down of the nuts in quantities and rotting. It affects chiefly the nuts, and causes great loss in yield, sometimes the entire gardens being covered with a thick covering of rotting nuts. It occasionally also extends to the stem through the peduncle and the tree then dies. But the number of such deaths is not considerable.

The disease usually makes its appearance with the beginning of the monsoon, is at its worst during the month of July and August and continues till the end of September. Occasionally the disease is said to occur as late even as November, if there should be late heavy rains. The climatic conditions, which favour the disease and enable it to assume the epidemic form are frequent heavy showers interrupted by breaks of sunshine.

We had occasion, during a recent tour in the Karwar District, to make inquiries both of officials and garden-owners in connection with the damage caused by this disease. The loss has been stated to vary from 10% to as much as 75% of the whole produce and in extreme cases the entire crop is reported to have been lost. Taking into consideration the total area under betelnut in the Karwar district (Sirsi—5800 acres, Siddapur—6445, Yellapur—2536, Honavar—1688, Ankola—742, Kumta—617, Total—17828 acres) it is easy to see that the loss due to this disease is very serious. The average produce per cent is stated between 1½ *Khandies* to 2½ according to the quality of the garden, which means an income of Rs. 150 to 250 per acre. Taking the average income to be two hundred rupees to the acre, the total money value of the betelnut

crop in the District would come to Rs 3,500,000 and the loss from the disease, calculated on the supposition that the average loss all round is only 25°/₀ amounts to as much as Rs. 900,000 at least per year.

The "*Koleroga*" appears to have been occuring ever since the cultivation of *Supari* began but as with many other fungoid diseases, its cause was abscure till quite recently. The people in those parts invariably attribute it to the rains of the Ashlesha Nakshatra, and believe it to be brought down by these rains directly. The possible connection of parasitic fungus was first suggested by Dr. Butler, Imperial Mycologist, Pusa, who found a species of Phytophthora on the rotting nuts. The disease was further carefully investigated by Dr. C. Coleman of Mysore and the results of the investigation and also of experiments in combating the disease have been published by him * He has definitely proved that the *Koleroga* is due to a *Phytophthora* which he names provisionally, *Phytophthora omnivora var arecæ*. If a nut which has just fallen from the bunch as a result of *Koleroga* attack be examined, its surface is seen covered with a greyish white, mould like, substance. If a tiny portion of this be scraped with a needle and examined under the microscope, it is seen to consist of a number of fine threads which constitute the vegetative part or mycelium of the fungus and of oval or elliptical, bodies which are the fruiting bodies of the fungus. The mycelium occupies the tissues of the nut and derives nourishment at their expense and as a result of this interference the nut falls to the ground where the injury is completed by numerous saprophytic fungi and bacteria and results in a general 'rot'. The fruiting bodies or sporangia of the fungus are produced outside on the surface of the nut. When mature, they liberate motile spores, known as zoospores, which are carried away by the wind in rain drops on to fresh healthy nuts, where they readily germinate and start fresh centres of attack. The zoospores are thus the chief means of spreading the disease from plant to plant. In addition to zoospores, this fungus produces, according to Dr. Coleman, another kind of reproductive bodies, the oospores. These are thickwalled resting spores, which lie dormant from one season to another by which the fungus is able to continue its existence from year to year. These probably remain in the diseased parts and possibly also in the soil, though, Dr. Coleman states that he has never actually observed them in these places, but has found them occuring abundantly in artificial cultures of the fungus.

* Bulletin No. 11. Mycological Series Mysore Department of Agriculture 1910.

With regard to the methods of combating the disease, the preventive measure universally adopted by the cultivators as a regular routine process in cultivation, consists in tying hoods or covers made out of the basal leaf sheaths of Areca leaves, known locally as "*Kottes*". The making of "*Kottes*" is quite an elaborate process. The leaf sheaths are collected, day after day, as they fall to the ground and are preserved carefully in a suitable place until the beginning of the rains. They are then cut into shape and stitched and made ready for use by skilled labourers. The actual *tying of* "*Kottes*" to the bunches requires even more specialised labour than Kotte-making. On the whole the process of Kotte-tying * is rather an expensive one, especially in Sirsi, Siddapur and Yellapur Talukas, where there are no local Kotte-tiers, these having to be brought all the way over from places below the ghats and from Mysore. Indeed the cost per acre of Kotte-tying in places above the ghats has been stated as varying from Rs. 15 to 25 and even Rs. 30 per acre. In Honawar, Ankola and Kumta, the cost of Kotte-tying is much less, but still considerable, varying from Rs. 8 to 15 per acre. Moreover, although Kotte-tying is fairly efficient in preventing disease, when done carefully and in good time, there are certain difficulties connected with it which reduce its efficiency considerably in practice. The "*Kottes*" are liable to rot by the heavy rains and to get torn off by strong winds. In places above the ghats, the services of the Kotte-tiers are not always available just at the right time. The cultivators there have to wait until the Kotte-tiers come over to them from places below the ghats, so that it often happens, that the disease has already appeared before the preventive measure is adopted and Kotte-tying does not do much good, once the disease is there. The cultivators know this, but such is the dread with which they look upon this disease that they go in for Kotte-tying at such expense, even on the off chance that it may give them some relief.

Now Dr. Coleman has been making extended experiments in Mysore during the last four years in combating the disease and it appears from his publications on the subject that he has had considerable success. He tried spraying the bunches with a mixture of Copper Sulphate, lime, and resin in certain proportions in several gardens, side by side with Kotte-tying. Summarising the results of experiments

* See Mollison's Text book on Indian Agriculture. Vol. III p. 260 for further details about Kotte-tying.

carried out at various centres in the Mysore province during 1909, he states, among other things, "that spraying with a mixture of proper constitution invariably proved more efficient than the tying of Kottes, even when spraying was done under comparatively unfavourable circumstances." "Spraying served to check the disease where the tying of covers proved practically of no avail." Further, "the materials for spraying (copper sulphate, lime and resin) can be supplied at a cost of Rs. 3 to 5 per acre." Also "spraying can be done almost three times as fast as Kotte-tying with the result that the cost of labour can be considerably reduced." "The total cost of spraying including labour and materials will hardly exceed that of Kotte-tying leaving out of account the cost of preparing Kottes."

In Circular No 3 on the Koleroga (Mysore Department of Agriculture) Dr. Coleman recommends the use of the following spraying mixture —

(*a*) 5 lbs. of Copper Sulphate dissolved in 12 gallons of water.

(*b*) 5 lbs. of Lime slaked in 12 gallons of water.

(*c*) 2 lbs. of Resin and 1 lb. of Soda } heated in 1 gallon of water till quite clear (about 1 hour).

(*b*) is poured into (*a*) accompanied by constant stirring and then (*c*) is added to make up the completed mixture."

This mixture is filled in a special kind of sprayers. These are worked by compressed air and their advantage consists in the fact that they can be conveniently tied to the back of the climber, leaving his hands free. The same men are employed to do the spraying as do the Kotte-tying at present. The spraying is commenced late in May or early in June and is continued whenever short breaks occur in the rains. The number of sprayings necessary depends largely on the rainfall. A second spraying is necessary, Dr. Coleman writes, in some cases, in August or early in September, if a slight sign of the disease occurs. In many cases only one spraying has been found sufficient.

In a recent letter Dr. Coleman writes to us that the work has been so successful in Mysore that he is planning to hand over the spraying operations to the garden owners themselves. This is very encouraging and it is to be hoped that the experiments which the Bombay Department of Agriculture contemplates at Sirsi and Siddapur will prove the superiority of the spraying treatment to the Kotte-tying to the satisfaction of the cultivators, and that they will eventually be relieved from the enormous losses which they suffer at present from the Koleroga disease.

Mannurial Supply for Sugarcane.

BY

G. N. Sahasrabuddhe, L. Ag.,
Barbados (West Indies)

WHEN I arrived in the West Indies the first thing that struck my attention was the low cost per ton of growing cane in those islands in spite of the high rate of wages prevalent here as compared to India. As the readers of this Magazine are aware the cost of growing cane in the Poona District, exclusive of the manufacturing expenses, comes very nearly to Rs. 400 for a crop of 40 tons *i. e.* the cost of growing per ton of cane there is Rs. 10. The cost of growing cane in the West Indies varies in different islands and may be taken as 6 Sh. to 10 Sh. *i. e.* Rs. 4-8 to Rs. 7-8 per ton. Of course here the cane is grown without irrigation, so that they have not to pay any canal-water charges, but that gain is compensated by the high rate of wages. In Poona district the usual rate of wages is as. 4-5, in the West Indies it varies from as. 12 to Re. 1-4 per day. This shows that in spite of the high rate of wages the West Indian planters produce cane at a much cheaper rate than we do in Poona. When I followed up the question more closely I found that this difference was mainly due to the cost of manure in the two places. In Poona half the expenses of the cultivation are due to manure. The Poona cultivator spends no less than Rs. 5 on manure to produce a ton of cane. In the West Indies the actual expenses for manure do not exceed Rs. 2 per ton of cane. In fact, as far as I am aware, there is no other country, except the Sandwich Islands where so much money is spent on manure as in Poona district.

Here a puzzle might appear how heavy crops of cane can be obtained without manure? Not that the West Indian planters do not apply manure but they make the cane itself pay for manure. As any body, who knows plant chemistry, can see, the products that we desire from sugarcane whether gul or sugar are carbohydrates, containing hardly any of the plant food materials. All these plant food materials remain in the waste products *viz.* tops, trash, megass and scum. So that if these are returned to the soil, for growing a crop of cane we do not make any serious demand on the plant food contained in the soil, the carbohydrates we seek for being products of water and air. The West Indian planter understands this fact and carries it into practice. Out

of the three bye-products trash and scum he returns directly to the soil. Megass he has to burn as fuel. But this megass is mostly composed of carbohydrates with small quantities of actual plant foods. He returns the ash to the soil. So that the only plant food he loses is a small quantity of nitrogenous substances. The tops are fed to the cattle and the dung and urine are returned to the soil as pen manure. So that he returns all the plant food materials that he obtains in the shape of cane *except that lost in combustion while burning megass* and in other manipulations. This loss he makes good by a small dose of some outside manure. Besides this small dose of extra manure he pays for nothing.

When the Poona cultivator burns all his trash as fuel, loses large stores of organic matter and nitrogenous substances. When he is a careful man he returns the ash and the dung from the cattle fed with cane tops. But the organic matter and the nitrogenous substances he loses by burning trash, have to be supplied in the form of purchased farm-yard manure and other manures purchased from outside at a great expense.

In order to make this point clear *i. e.* how much loss is sustained by our cultivators in burning trash I had asked Mr. P. C. Patil, the Divisional Inspector of Agriculture, Central Division, to make some determinations about the quantity of trash obtained per acre. From the data kindly supplied by him I get the figures given in the adjoining table. Samples of trash were submitted to Dr. Mann for analysis and I am obliged to him for the analytical data. In these determinations, unfortunately the actual weight of cane per acre was not determined and I am obliged to give approximate figures in the last two columns :—

No.	Trash lbs. per acre.	Composition %			Quantities lbs. per acre.			Approximate cane crop lbs. per acre.	lbs. of cane to a lb. of trash.
		N.	K_2O	P_2O_5	N.	K_2O	P_2O_5		
I.	7520	0·37	0·73	0·16	27·824	54·896	12·032	67200	8·9
II.	10380	0·38	0·50	0·09	39·444	51·900	9·342	89600	8·6
III.	9412	0·38	0·50	0·11	35·766	47·060	10·352	78400	8·3

The Roman figures in the first column are as follows :—

I. Quantity of trash obtained in Walwa taluka (Satara district). Cane under well-irrigation. Green leaves dripped while cane growing. Mean of two observations.

II. Quantity of trash obtained in Nira Valley first-plant canes. Cane under canal irrigation. Mean of five observations.

III. Quantity of trash obtained in Nira Valley from ratoon canes. Cane under canal irrigation. Mean of three observations.

From the above figures it is clear that by burning trash the cane cultivator loses 4 to 4½ tons of a valuable organic manure which is equivalent to about 10 cart-loads of farm yard manure as far as the bulk is concerned. This loss has at present to be made good by purchasing farm yard manure from outside. Now in the Poona district the price of the farm yard manure thus purchased is Rs. 2-2½ per acre; *i. e.* burning trash costs the cultivator Rs. 20 to 25 per acre. If this trash is saved it means that this much is a net gain to the cultivator.

In West Indies the trash is regularly used as manure in this way. After harvesting the plant cane, all the trash is arranged in alternate furrows and the furrows from which the trash is removed are ploughed up. After harvesting the first ratoon crops, the trash is arranged on the furrows which were previously ploughed up, and the furrows which were previously covered with trash are now ploughed up. So that the position of the furrows in successive years becomes like this.

PLANT CANE.	FIRST RATOONS.	SECOND RATOONS.
Cane row.	*Cane row.*	*Cane row.*
Furrow.	*Trash arranged.*	*Ploughed up.*
Cane row.	*Cane row.*	*Cane row.*
Furrow.	*Ploughed up.*	*Trash arranged.*
Cane row.	*Cane row.*	*Cane row.*
Furrow.	*Trash arranged.*	*Ploughed up.*

Of course in the West Indies cane is grown on rain water alone and therefore this system of arranging the trash does not offer any difficulties. But in India on account of the necessary irrigation system, such an arrangement of trash on the field is impracticable. But there the trash can be removed from the fields and stored into some adjoining pit where it will rot properly till the time of application comes.

Now here a question will arise, what about the fuel supply? The trash is at present burnt as fuel and unless we have some other cheap source of fuel, money gained by conservation of trash will be spent in

buying fuel. But this difficulty is only superficial. As a matter of fact the fuel supplied by cane in the form of megass is quite sufficient to evaporate all the juice. At present we have to burn trash in addition to megass because we are still contented with our old methods of boiling. There is no other country besides India where they burn trash for want of fuel. I cannot enter into details here, for want of space, about how this is done. But I can assure the readers that I have gone through this whole question of fuel supply very carefully, and I am perfectly convinced that if we give up our present method of evaporation on open fire and if we allow steam to do that work not only we shall not require any other fuel besides megass but we shall get a better product at a distinctly less cost than we do at present.

Now supposing we are prepared to save our trash let us see how we stand as regards our mannurial expenses. At present we grow a crop of 40 tons of plant-cane to the acre the usual dressing is about 10 tons of farm yard manure and about 1 ton of oil cake. At present the farm yard manure supplies most of the large quantity of organic matter that is necessary to grow cane under irrigation system; while the oil cake supplies the majority of the nitrogen, potash and phosphoric acid. In the form of these two manures we are at present supplying to the field about 10 tons of organic matter, about 350 lbs. of nitrogen, 150 lbs. of potash and 100 lbs. of phosphoric acid in round figures. Experiments have shown that these quantities are essential to get a good crop of cane. Now in Poona district it is usual to get two crops of cane on the same land *viz.* plant-cane crop and ratoon crops. From these two crops, as can be seen from the figures given above, we get 19792 lbs. of trash (or very nearly 20000 lbs.) which furnishes 75·21 lbs. nitrogen, 98.96 lbs. potash and 19·69 lbs. phosphoric acid and approximately 7 tons of organic matter. If this whole trash is saved and applied to the soil there remains to be supplied 3 tons of organic matter, 274·79 lbs. of nitrogen, 51·04 lbs. of potash and 80·31 lbs. of phosphoric acid.

We can ask nature again to supply part of these constituents by growing green manure crops for instance. By growing green manure crop, we manufacture a manure on the spot instead of getting it from outside. Of course, the green manure crop gets its supplies of potash and phosphoric acid from the soil itself so that these are not actual additions but as regards nitrogen and organic matter, these we get from air and water and *therefore these are distinct additions. From the time* the last crop is taken off from the land which is to be put under cane

till the time cane is actually planted, there is usually ample leisure to take a green dressing crop, so that no time is wasted. Then again the preliminary cultivation that has to be given for cane land will enable to take a green dressing crop without any extra expense except the cost of seed which is comparatively trifling. So that the addition of nitrogen and organic matter that we get through the medium of a green dressing crop costs us hardly any thing.

Let us see what we actually gain by it. Here again I am indebted to Mr. Patil and Dr. Mann for the data. Mr. Patil has found out that a *green dressing crop of san (crotalaria juncia)* at the time of flowering weighs from 16000 lbs. to 28000 lbs. per acre according to the condition of the crop, and its composition as given by Dr. Mann is as follows :—Moisture 80 5°/₀; Nitrogen 1·77°/₀; Potash 2·09°/₀; Phosphoric acid 0·97°/₀. Taking the mean of Mr. Patil's determination we get an average crop of 22000 lbs. per acre and this much crop furnishes us 4290 lbs. of dry matter containing 75·93 lbs. of nitrogen, 89·66 lbs. potash and 41·61 lbs. phosphoric acid. So that with trash and a green dressing of san we meet the demand for organic matter and potash fully. There is a deficit of about 200 lbs. nitrogen and about 40 lbs. phosphoric acid. This deficit can be made good by a manure like fish which *is very rich in both nitrogen and phosphoric acid* or we might use some suitable chemical manure to supply these two ingredients. Fish usually contains 8 % nitrogen and 7 % phosphoric acid, so that 2500 lbs. of fish per acre will supply all the nitrogen required and a large excess of phosphoric acid. Of course it will all depend upon the current market rates as to which manure will be more economical. But considering generally this top dressing of manure, which will have to be actually paid for, need not cost much over Rs. 100 per acre. This shows that using trash a manure and growing a green *dressing of san, both of which practically cost very little, will save to* the cultivator nearly Rs. 100 per acre thus reducing the cost of cultivation to Rs. 300 *i. e.* about 7-8 *per ton of cane produced, which comes* near to the cost of cultivation per ton of cane in most other countries.

But all this depends upon the saving of trash and saving of trash means giving up our prehistoric method of boiling that we at present follow. Steam has done wonders in many other industries and it will do similar wonders to the Poona cane grower provided he is sincerely tired of remaining behind the world.

A new Gul boiling furnace for the Deccan.

BY

P. C. Patil, L. Ag.,

Divisional Inspector of Agriculture.

IN this furnace I have tried to combine the good points in the Poona and the Khandsari furnaces. The latter is found in the United Provinces. The pan used on the Poona furnace supplies a larger evaporating surface and the furnace has got an under-ground passage to supply fresh air and an ash pit for receiving the ashes from the furnace. In the Khandsari system a series of five hemispherical pans is arranged over a corresponding line of furnaces and the hot gases from the lowest or the first furnace are passed under the remaining ones and are finally allowed to go out through an exit hole on the other side of the highest or the last furnace thus taking the greatest advantage of the heat generated in the lowest furnace. The exit hole, allowing, as it does, the used up gases to escape serves as a chimney.

It is presumed that the readers of this journal know the Poona furnace. The details of the Khandsari furnace and pans do not seem to be necessary.

The section of the proposed combination (figure 1) makes all the details of construction clear. The wall of the lower furnace (*i.e.* Poona type furnace) has a bore 16 inches wide and 9 inches deep about two feet six inches from the bottom of the furnace. The hole opens up in the shallow saucer shaped furnace about eight feet in diameter, placed a little above the first, to the other end of which a chimney connection is opened.

The storing pan is kept on the upper furnace and the sugarcane juice, as received from the mill is stored in this pan. This has been provided with a cock. By means of this cock and a trough the juice, in the storing pan is led to the lower or the boiling pan to finish the final concentration therein. When the *gul* is ready the pan is taken off in the usual way and emptied into the cooling pan. It is then returned on to the lower furnace to receive another dose of juice. To start with, juice has to be put in both pans, one charge in the boiling and one in the storing pan.

In constructing this kind of furnace it is advisable to put the lower or the Poona furnace a little deeper in the ground than is usual. By this arrangement the juice will not have to be lifted unnecessarily high.

In the preliminary trials, the temperatures and specific gravities were taken to get some idea of the value of the waste heat. Of the several trials one is given below to illustrate the use of this waste heat.

Operations when temparatures were recorded.	Time at —	Temperatures in degrees. Boiling pan	Temperatures in the store tank or pan.	Remarks.
Firing the furnace begins...	A. M. 11-53	30	30	Corrected specific gravity 16·87
Scum is gathered in the boiling pan	P. M. 12-28	85	37°	
Boiling begins in the boiling pan	12-37	96°	52°	
Boiling pan is ready to take off	2-53	116°	88°	do. do. 22·94 (often it goes up to 26·5).

As will be seen from the above table we started with at 30°C. at 12-28 p. m. *i. e.* after 35 minutes when scum gathers on the juice in the boiling pan the temperatures rise by 55 and 7 degrees respectively in the two pans. At 12-37 p. m. a further rise of 11 and 15 degrees is recorded. At 2-53 p. m. when the boiling pan was ready (at 116°C.) the juice in the tank has risen to 88°C. So the waste heat has raised the juice (1000 lbs.), from 30° to 88°. (In some cases it has reached 97° even) and has evaporated a good proportion of water in the juice.

To start with we have got for every 100 lbs. of juice 16·87 lbs. solids and 83·13 lbs. water. By the time the boiling pan becomes ready the juice in the tank is concentrated and it contains for every

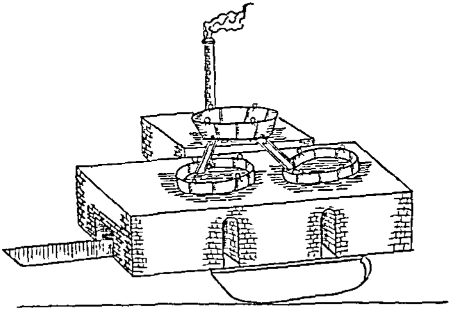
100 lbs. of the concentrated juice 22·94 lbs. of solids and 77·06 lbs. of water. We must however remember that the total quantity of solids in the given quantity of juice has not increased. On account of the evaporation of some water the proportion of the solids to water has increased.

The quantity of water per 100 lbs. of original juice is, therefore, as follows:—at the beginning 83·1 lbs.; at the end 56·9 lbs. 26·2 lbs. have therefore been evaporated by the waste heat, or nearly one-third, before the juice is delivered in the boiling pan.

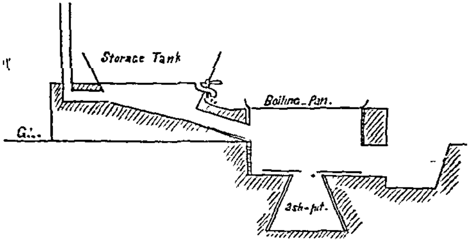
In the month of May 1911 this furnace was tried with the Poona furnace. The results of the tests made are recorded in the following tables:—

THE NEW FURNACE						THE POONA FURNACE.					
Date	Serial No. of Pan	Juice in lbs	Time required to boil	Kind of fuel	Quantity of fuel to boil Pan	Date	Serial No. of Pan	Juice in lbs	Time required to boil	Kind of fuel.	Quantity of fuel to boil a Pan.
May 4th 1911	1	1000	2 37	Not weighed							
„	2	„	2 22		.						
6th	1	„	2 38	Megass	443						
„	2	„		do.	271		2	.	..	Megass	329
8th	1	„	3-20	do	430	at Sholapur	1	1000		do	358
„	2	„	2-5	do	242	May 31st	2	„	2 16	do	276
„	3	„	2-7	do	242						
„	4	„	2-9	Trash.	218	8th May	1	1000	2-	Trash.	395
10th	1	„	3-7	do.	446	10th		„	2 45	do.	391
„	2	„	1-52	do	202	„	2	„	2 29	do	340
„	3	„	2-3	do.	262	„	1	„	...	do.	587
„	4	„	1-42	do.	262	„	2	„	..	do	462
	1	1100	3 7	Megass	468	24th April	1	1100	...	Megass	384
	2	„	1 55	do	283	31st May	2	„	2 22	do.	289
	3	„	2-8	do.	283	24th April	3	„	...	do	358
	4	„	2-15	do.	277	„	4	„	...	do.	317
	5	„	2-2	do	277						
	6	„	1-55	do.	277						

Sketch of the New furnace



Cross-Section.



From the above statement we see that the Poona furnace takes about 2½ hours to boil down 1000 lbs. of juice to *gul* and requires 358 lbs. of megass (or 353 lbs. of trash or *pachat*) for the first *Adhan* (charge) and about 325 lbs. of megass (or 340 lbs. of trash) each, for subsequent charges.

The new furnace (figure 1) requires 3 hours and 10 minutes to boil the first Adhan consuming about 426 lbs. of megass (or 446 lbs. of trash) and all subsequent Adhans only two hours each requiring about 212 lbs. of megass (or 262 lbs. of trash) only.

The Satara furnace requires about 656 of lbs. megass to boil 1353 lbs. of juice and takes from two to two and half hours for each boiling (or by proportion about 484 lbs. of fuel for 1000 lbs. of nice).

Taking a day's output to be 1353 × 6 = 8118 lbs. of juice (for Satara, as usual there), the consumption of fuel and the approximate times required by the three different furnaces will be as under:—

Kind of furnace.	Fuel required daily.		Fuel required per acre or for (36000 lbs. of juice)
	Megass lbs.	Trash lbs.	
Satara furnace	3936	3936	17456
Poona furnace	2683	2832	11858
The new furnace	2227	2276	9876

Taking 65 per cent. extraction with 60 per cent. moisture in the fresh megass, we get 14 lbs. readily combustible megass for every 65 lbs. of juice. The quantity of dry megass for 36000 lbs. of sugarcane juice, therefore, works to about 7754 lbs. In actual practice however only about 7200 lbs. of dry megass is collected. The trash or sugarcane leaves from one acre, if carefully collected will weigh about 7000 lbs. (In the Satara District). In practice however only about 500 lbs. of trash is available for burning purposes. The total quantity of fuel available (megass and trash together) is therefore 12200 lbs.

Kind of furnace.	Fuel available per acre lbs.	Fuel required per acre lbs.	Extra fuel required for an acre lbs	Fuel left per acre.
Satara furnace	12300	17500	4800	...
Poona furnace	12300	11900	...	400
New furnace	12300	9900	...	2400

From the above table we see that the Satara furnace requires 4800 lbs. (over and above the available trash and megass costing Rs. 20/-) and the new furnace not only requires no additional fuel other than trash or megass, but with it there is a surplus of megass and trash of 2400 lbs. per acre, which can be sold or kept as manure. (The trash is rich in manurial value). Vide the appendix I.

The Poona furnace neither requires additional fuel nor admits of any considerable saving.

The new furnace requires considerably less time than either the Poona or the Satara furnace which is a point of very great importance for the Satara cultivator who boils five to eight pans a day on one furnace.

The introduction of this new furnace is calculated to effect a saving in labour in addition to a large part of trash in the Sholapur District.

In some places in Sholapur District the cane planter uses two furnaces and in majority of cases four furnaces for each mill. One mill supplies juice for all these furnaces; thus each furnace has to boil only two *Adhans* a day (instead of four as in Poona and six to eight as in Satara District). Each Adhan takes about four hours.

If however the new furnace be used instead, both time and labour can be economised; in fact one double furnace, that is to say, one furnace of the new type, can treat all the eight *Adhans* as proposed for Satara. But the people in Sholapur District are accustomed to boil only two, they will consider it hard job to boil eight Adhans and I therefore propose modification of the same for Sholapur.

Figure 2 gives a diagram of the plan proposed for Sholapur District. The two boiling pans are placed on two separate furnaces

(and are fired independently) having the store pan alone common,—placed on a raised shallow furnace without any ash pit or underground passage for admitting air. The hot gases from the two lower furnaces are led through holes (as in figure 1) to this common furnace where it heats the juice in the storing pan as described in the last case and finally escape through the chimney. Two *Jalatas* and two *Gulatas* will thus do the work of four *Jalatas* and four *Gulatas* working for about the same number of hours. In Sholapur District the cultivator spends much money to build a line of four furnaces as well as to purchase four boiling pans and four cooling pans. The construction of this new furnace will certainly cost less; moreover he will save the cost of one boiling and two cooling pans. Leaving the saving in the initial expenditure, the cane planter can save, at any rate, the labour of *two Jalatas* and *two Gulatas* or say about Rs. 3/- a day or about Rs. 14/- an acre, taking about 7000 lbs. of gul to be the average outturn per acre.

APPENDIX I.

Samples of trash were sent to the Agricultural Chemist for analysis to ascertain the value of manurial ingredients in the trash. The subjoined table gives the analysis supplied.

	Pundya trash Manjri.	Islampur pundya trash.	Baramati Ratoon trash.	Baramati New cane trash.	Khadya cane trash.
Nitrogen ...	·36	·37	·38	·38	·33
Potash ...	·74	·73	·50	·50	·54
Phosphoric acid	·09	·16	·11	·09	·10

From this table we see that about 10 lbs. nitrogen, 15 lbs. potash, and 3 lbs. phosphoric acid can be secured from the surplus trash left by the use of the new furnaces. From a purely theoretical point of view about Rs. 9/- worth manure is thus secured out of the available fuel. From a practical business point of view it may or may not pay to use this as manure and I leave the question for some future article.

Notes on the Cultivation of the Soil.

BY

K. M. Powar, B. Ag.,

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IN this and in some succeeding articles, I wish to give a short report of the work done by the students of the Vernacular Agricultural School Poona with the results which they have obtained. In the present I mean to give a short account of the *rabi* crops which were raised by them in the last season on the agricultural college farm.

For this three plots were reserved each of four gunthas. In reserving these plots the intention was to show the boys the importance of thorough cultivation. Each plot was again subdivided into portions of two gunthas. The previous treatment given for each was as follows :—

The land was first ploughed once with the cross plough. The clods were broken by the ordinary *mainda* and one harrowing just before the rains. The plots were almost level. No manure was given to the plots; but the previous crop was an irrigated garden crop. There was a difference in the after treatment, one plot being given harrowing every eighth day and the other every fifteenth day.

Generally two or three barrowings are given to the land reserved for *rabi* crops. But here it was purposely arranged to treat the land so as to show the effect of extra cultivation.

The crops sown were *Shalu Jowar* (*Dagadi*), wheat (Bakshi) and gram. All other factors namely seed rates, variety, etc. were the same. No irrigation was given. The *shalu* and gram plots were sown in the last week of September and wheat in the first week of October.

Before sowing the harrow was used for cultivating the land and afterwards the ordinary hoe with slit was used. The interval was the same. This hoe was continued until the crop was nearly six weeks old, and after this another hoe without any slit was employed. The distance between the rows was one foot. The distance was purposely kept large to facilitate the work of hoeing. This was continued till the crop was two and a half to three months old.

" Hullya " The well known bullock on the Dharwar Farm, that can draw thirty two loads.

The results obtained are as follows :—

	Harrowing every 15 days. Crop. pailies.		Number of harrowings.	*Harrowing every 8 days.* Crop. pailies.		Number of Harrowings.
Shalu.	— 5	—	4	8	—	8
Wheat.	— 3	—	5	4	—	9
Gram.	— 8	—	5	9½	—	9

From the above figures we clearly see that the outturn was very largely increased by the extra cultivation which was given to the plots. From the above experiments it was clearly seen that more care means more outturn. And the boys were convinced of this.

The chief object of cultivation as usually done, may be stated as follows. In the first place weeds are killed. In the second, perhaps the even more important purpose of conserving the moisture in the soil is secured. The soft surface also favours the absorption of any rain water that may fall. It decreases evaporation and hence maintains an *even temperature by acting as a sort of covering to the soil.*

It favours aeration and leads to the oxidation of the poisonous materials arising from decaying organic matter and supplies oxygen to the soil bacteria.

It is also important to cultivate at the right time in order that those purposes may be properly served. To preserve moisture the right time means as soon after rain has fallen as possible, and the same time is suitable for the destruction of weeds. For the weeds germinate at that time and destroys them immediately. The soil must of course be dry enough to cultivate or damage would be done to the tilth. It would be wrong, however, to leave it until ten days after the rain when the weeds have grown largely and the surface soil is hard enough to turn into clods when worked. To cultivate at the wrong time means less work and more expenses because the soil being hard and weedy cannot be worked easily.

From the above figures it is clearly seen that frequent cultivation brings in more outturn. But at the same time it must be done when the soil is in suitable condition otherwise it may do more harm than good.

Preliminary Observations on some Drought Resisting Plants of the Deccan.

BY

G. B. Patwardhan, B. Sc.,

Superintendent, Ganeshkhind Botanical Gardens.

DURING the days of anxiety caused by the withering condition of crops of some plots in the Ganeshkhind Botanical garden, Kirkee, undoubtedly caused by the unusually long drought which has prevailed since the early sowings of crops after the first showers of June 1911, the writer's thoughts became diverted to observe the effect of the weather conditions on weeds and unsown vegetation. Accordingly in the course of three days from 26th to 29th July (1911), observations were made in the Ganeshkhind garden and the neighbourhood and as a result two small lists were prepared one of plants which presented a distressed appearance due to want of enough vitality to withstand even the beginnings of a dry season and another of those which fared well under the same conditions. In the plants of the former group (A) the leaves had flagged, the margins of the lamina curled up, and they also often drooped down from the tip of their petioles (*Lagasea mollis*). In some cases only a truft of leaves at the extremity of the plant remained alive, the lower ones having dropped already (*Lagasea mollis* and *Euphorbia geniculata*). In others, the life of the plants was hastened to completion by the formation of flower-buds on the terminal axis (*Zinnia*). In the latter group (B) a large number of plants were of spreading habit and deep rooted. Some completely covered the ground underneath by a dense matting of their procumbent branches. There were a few others also of an erect habit (*Psoralea corylifolia* & *Sesbania aculeata*). In list B, comparatively, plants belonging to the Leguminoseæ are greater in number than those of any other orders so far examined. The plants mentioned in the lists were found growing in or on the margins of cultivated fields under completely dry surroundings mostly in medium black soil of fair depth.

List A.

Cassia occidentalis Vern. *Thorla Takla.* (थोरला टाकळा)

Cassia tora—Vern. *Takla.* (टाकळा)

In the above two examples, only those growing along road sides were observed.

Lagasea mollis.
Zinnia elegans.
Nyctanthes arbortristis. Vern. *Parijat.* (पारिजात)
Plumeria acutifolia. Vern. *Kherchafa.* (खेरचाफा)

The two above mentioned trees were in an unirrigated border.

Bauhinia tomentosa.
Datura fastuosa.—Vern. *Dhotra.* (धोतरा)
Nicandra phaseoloides.
Ipomoea muricata. Vern. *Bhowri.* (भॉवरी)
Ipomoea coccinea.
Ipomoea quamoclit. Vern. *Ganeshrel.* (गणेशवेल)
Tecoma stans. Vern. *Nagchafa.* (नागचाफा)
Oroxylum indicum. Vern. *Tetu.* (टेटू)
Barleria cristata.—Vern. *Koranti.* (कोन्हान्टी)
Sanchezia nobilis, *Duranta plumeri*, *Acalypha wilkesiana* } These three were in a shrubbery not irrigated for a long time.
Euphorbia geniculata. Vern. *Dudhani.* (दुधाणी)
Comphrena globosa Vern. *Gultop.* (गुल्टॉप
Achyranthes aspera. Vern. *Aghada.* (अघाडा)
Guazuma tomentosa.
Montansa workleii (?) planted in an unirrigated border.
Canna indica. Ditto. Vern. *Kardali.* (कर्दळी)
Wrightia tomentosa. Ditto.

LIST B.

Psoralea corylifolia Vern. *Baochi.* (बावची)
Alysicarpus longifolius Vern. *Shevra.* (शेवरा)
Alysicarpus rugosus.
Alysicarpus pubesecus?
Indigofera glandulosa Vern. *Barbada.*
Phaseolus trilobus. Vern. *Jangli Math.* (जंगली माठ)
Heylandia latebrosa Vern. *Godhadi* (गोधडी)
Tephrosia purpurea Vern. *Unbali.* (उनवळी)
Crotolaria orixeusis.
Polygala chineusis Vern. *Negli.* (नेगली)
Sesbania oculeata Vern. *Ranshevri* (रानशेवरी)
Indigofera linifolia Vern. *Barbada.*
Cassia pumila Vern. *Sartual.*
Rhyncosia minima.

Acacia lencophloca Vern. *Hewar.* (हीवर)
Tannez nudicaulis Vern. *Pathri.* (पथ्री)
Echinops echinata Vern.
Tridan procumbens.
Cardiospernum helicacabum. Vern. *Kapal phodi.* (कपाळ फोडी)
Dodonea viscosa Vern. *Jalhmi.* (जलमी)
Hibiscus ficulneus. Vern. *Ran bhendi.* (रान भेंडी)
Biophytum sensitivum.
Lavandula Burmannii.
Cryptostegia grandiflora.
Capparis horrida.
Ipomoea hederacea Vern. *Bhowri.* (भोंवरी)
Ipomoea reniformis. Vern. *Undirkani.* (उंदीरकणी)
Argyrea cuneata. Vern.
Acalypha malabar.
Lantana camara.
Guiacum officinale.
Trichodesma indicum amplenicaulis
Vitis carnosa. Vern. *Tamnyz* was found growing among grass. (तामन्या)
Commelica forskalcii. Vern. *Kena.* (केना)
Cassia mimusoides.
Phyllanthus scabrifolius.
Phyllanthus madraspatancusis Vern. *Kanocha.* (कनोचा)
Euphorbia hyperecifolia Vern. *Dudhmogra.* (दूध मोगरा)
Euphorbia pilulifera.
Corchorus trilocolaris.
Justicia diffusa.
Oldenlandia aspera Vern. *Phapti.* (फाप्टी)
Anotis montholmi. Vern. *Fuli.* (फुली)
Ischoenum pilosum Vern. *Kunda* grass. (कुंदा)
Aristida hystrix.
Manisuris granularis.
Panicum isachne.
Setaria glanca.
Cenchrus biflorus
Apluda varia.
Andropogon annulatus.

Kanmi Cotton Cultivation in Anand Taluka.

BY

M. L. Patel, B. Ag.

THE cotton, known as *kanmi*, in the tract which lies round the town of Anand is similar to Broach cotton. The tract itself is typical of Northern Gujarat, possessing a soil which is best characterised as a sandy loam. Under these circumstances *kanmi* cotton, having a long growing period is generally grown where there are irrigation facilities. The cultivators have, therefore, invented an ingenious method of saving irrigation charges, which are very heavy on account of the wells being from fifty to seventy feet deep.

In this tract Lady's fingers or *Bhindi Hibiscus Esculentus* is taken as a hot weather crop. Previous to the last one or two irrigations of the *bhindi* crop, *kanmi* cotton seeds are sown among the plants. This takes place in the beginning of May. Thus the seeds grow for fifteen to twenty days under these irrigations, which must in any case be given for the *bhindi*, without any special cost. After the first rainfall, the cultivators uproot the *bhindi* plants and cultivate twice between the cotton plants with an ordinary hoe at the interval of a week. After the second rainfall they transplant *Barto* (*Elensine cororana*) seedlings in alternate rows with the cotton plants. The *Barto* is ready about the end of October and normal outturn is about thirteen hundred pounds per acre. The picking of cotton begins from the middle of December and hence the crop is not much affected by frost if this occurs. In the season 1910-11 though there was severe frost, the outturn of seed cotton was, on the average, about two hundred and eighty pounds per acre.

Contribution to the study of lac.

BY

T. R. Kotwal.

Is Babul (Acacia arabica) lac a distinct species and requiring mother-lac from Babul to start the cultivation ?

My report of my experiment has raised this question. The entomologist to the Baroda State has written to me to the following effect: "I have read your account of 'Experiments in lac inoculation' published in the Poona Agricultural College Magazine Volume III, No. 1 pages 42—44, with great interest and pleasure. I am anxious to know whether you innoculated the different kinds of trees with the seed sticks of *Bor* (*Zizyphus jujube*) tree or with those of corresponding trees."

I have answered this question in a letter I sent to the Daily Indu Prakash, Bombay, on the 7th June 1911. I have therein quoted Mr. Lefroy (The Agricultural Journal of India Vol. IV, part III, July 1909), but the question may perhaps be discussed in these columns. Mr. Lefroy says: "*Babul* lac is apparently a distinct species and to start the cultivation one must obtain the mother-lac from *Babul*." In order to decide this question I brought mother-lac from Pusa and innoculated, with the mother-lac from *Bor* (*Zizyphus jujube*), two Babul trees at Saswad. The experiment succeeded. A sample was sent to Dr. Harold H. Mann, with a short history of the experiment.

Before my experiments I had studied Mr. Lefroy's excellent article. I wrote to the Deputy Director of Agriculture, Sind, for mother-lac from the *Babul* tree but I got a reply to the effect that "it would be advisable to apply to Mr. Lefroy as nothing has been done with lac in Sind so far. It exists here in a natural state on *Babul* trees and is not propagated artificially."

My heart was set upon experiments on *Babul* as Mr. Lefroy remarks that the potentialities of the tree as a lac producer equal those of *Bor* and there is immense scope for rendering profitable lands that are now of little value except as a source of firewood and grazing for goats. Though foiled in my attempt to get *Babul* mother-lac the enthusiasm created by Mr. Lefroy's article found vent in another direc-

tion and I resolved to innoculate *Babul* trees with *Bor* mother-lac. Great was my joy when I won the knowledge that the cautious language of Mr. Lefroy was justified. It is proved that to start the cultivation on the *Babul* tree one can innoculate it with *Bor* mother-lac, or with mother-lac from *sitaphal* (*Anona sequamosa*). I have successfully used this latter mother-lac in June 1911 for innoculating a *Babul* tree at Saswad. The insects are in a healthy condition and are five weeks old.

Mr. Stibbing remarks : "There may be more than one species, sub-species, or race of the lac insect present in the country. This point although of very considerable scientific interest and importance, has not, upto the present, received much attention." Mr. Lefroy shares the above view and as my experiments throw a light on the question and the view of Mr. Lefroy that *Babul* lac is a distinct species are open to reconsideration I place my results before the public. My experiments show that at any rate, the lac which grows on the *Babul* tree is not essentially distinct from that growing on the *bor* or on the *sitaphal*. I may note in passing that the mother-lac I used for *sitaphal* was from *Bor* and obtained from Pusa.

The geneological table of my experiments would be thus tabulated.

Mother-lac from Bor from *Pusa*.

- Babul
  - Babul
  - Tur (*Cajanus Indicus*)
- Sitaphal
  - Babul
- Umber (*Ficus glomerata*)
- Bor.

I do not give the complete list as the experiments are still in progress. Enough is given to elucidate the point in controversy. In the light of my experience and experiments *Babul* trees have been inoculated in two places at Saswad and three places in Talegaum Dhamdhere, Poona District.

Surat.—Here we were accommodated in the travellers' Bunglow by the side of the river Tapti, and the Government Farm extending over 200 acres was hard by. On this there are many series of experiments. The first of these to notice was designed to ascertain the comparative value of manures—artificial as well as natural and the exceptional position as to value possessed by cattle and other farmyard manure was quickly evident. Another experiment was designed to test the effects on the soil of Night soil and Poudrette, and the marvellous effect of both was obvious. The latter was however distinctly inferior to the former. All the experiments were beautifully carried out. In the evening we were shown the Gujerat method of straight sowing practically, but we were disappointed with the skill displayed. The next morning we went to see the very high cultivation of garden crops in the neighbourhood in lands owned by a private gentleman who—it is said—reaps enormous profit from this type of agriculture. Here we were given a tea party by the past students—Messrs. *Patel*, Naik and Shukla.

Songhad.—We were here as guests of the Baroda State. In the morning as soon as we were up, we started to see the fort. This fort being situated 1600 feet above see level and the extreme steepness and the abrupt winding made it quite impossible to go to the top of the hill without any halt on the way. On coming down we proceeded to the farm attached to the Bhil school here. This farm is conducted as a genuine farm run on economic lines, and is conducted very ably by the boys themselves under the supervision of the careful Headmaster. We could well see there how Bajri crop sown early was spoiled by the incoming early rains at the flowering time. The Director of Agriculture of Baroda, Mr. Shitole, took great pains to show us everything.

We left Songhad for the station Nandbare and thence from Nandbare to Dhulia we had a very tiresome journey of 24 miles, but that gave us the opportunity of seeing both sides of the road—the disastrous condition due to the excessive drought of the present year.

Dhulia.—Here we had nothing to see on the farm except one or two cotton crosses as the failure of rain has been so complete as to destroy practically everything. Only four inches of rain had fallen since May, as against an average of twenty two inches. We could clearly see what the miserable condition of the cultivators of that district will be during the coming months.

Ahmednagar.—On the morning after our arrival we were taken to the plots where the experiments of dry-farming are being conducted under Mr Knight's supervision. The experiments in timely conservation of moisture, in careful clean cultivation, and in seasonal sowing versus rainfall sowing, are worthy of being visited by way of instruction by the cultivators round about. In the evening we went to Mr. Cursetjee's garden to see the cultivation of *Ganja* and fruit trees. While returning we were called to a tea party by Mr. Kathawate B. Ag. There we had an interesting talk with his father—a retired subjudge who expressed on that occassion that B. Ags. should try to bring their knowledge to an advantageously practical use—there being a vast field open for them to undertake many enterprises. He added that if Government be willing to give out lands lately deforested on some conditions for cultivation, his own son would be the first man to go in for that.

Here ended our tour in the Northern part and after returning to Poona, we started again for Southern Maratha Country.

Hukeri Road.—The Gokak farm was visited by us in the morning. There were some few experiments on this farm. Two of these we particularly noticed. One was an attempt at reclaiming some plots on the farm (which were totally out of cultivation by the profuse encrustation of salts) by laying out drains. The other was an experiment in the cultivation of Cambodia cotton to get the largest yield. It seemed to show that this farm is an ideal place for the growth of this cotton.

While leaving the Gokak station we were given a hasty party by the Members of the Gokak Agricultural Associations.

Belgaum.—The Government Farm here is very small, and the only experiment was one on the thick sowing of potatoes. Here bags were tried and proved successful to prevent the damage from rice-grass-hoppers. Here Messrs. Nazare and Kangle gave us a grand tea party.

Hubli.—We did nothing here practically except that we took a morning stroll round about the fields near by to see the queer mixtures and the clean cultivation in the fields. The great damage done to *jowari* by the grass-hopper was very evident here. They were found living in the leaf sheaths and had no wings.

We were here entertained to tea by the Lingayet community.

Dharwar.—The chief object of interest here was the Government farm extending over an area of two hundred acres. Mr. Ranade, the Superintendent took us round the whole farm and explained to us the experiments. These were very numerous. Among them was a series conducted in order to ascertain the comparative value of various different manures, very similar to one laid out on the Surat farm; another was designed to show the ingredients specially wanting in black soils and so on. All the experiments were conducted very ably. The cultivation was clean all through. Plots were remarkably straight-sown. On this farm we saw one bullock who was reported to have drawn quite alone, unaided, thirty two loads of *san* and *kulthi*. From the photo given in this number it can be clearly seen what a magnificent animal he is. A pair (this bullock and some other) was bought three years ago for Rs. 335 but this bullock of above description is at present asked in the market for Rs. 300. His very large body, huge limbs and his appearance have a great similarity to those of a bullock of the Krishna valley breed, but the horns are quite different. The actual measurments of this bullock are as follows :—

Height over the hump		Height behind the hump		Girth.		Length of the body		Length of the horns		Length of the face		Breadth of the face		Breadth of the forehead		Length of the ear	
ft	in.	ft.	in	ft	in	ft.	in	ft.	in	ft.	in	ft	in	ft	in	ft	in
5	5½	4	7	7	1	5	2	1	4	2	1	0	8	0	10½	0	11

Afterwards Mr. Shevade lectured on cotton improvement, its possibility and the methods by which it can be brought about. Broadly he gave us three ways: 1 Introduction of new varieties. 2 Selection and 3 Hybridisation. He told us that by crossing two varieties of *Kumpta* he succeeded in improving its ginning per cent. and colour. Our hosts on the farm kindly gave us a tea party before leaving. We met our F. Ag. friends here and a grand cosmopolitan dinner was arranged which was graced by Dr. Mann and Prof. Knight.

We left Dharwar for Marmagoa and on our way to it we had a view of some of the most beautiful and picturesque scenery in the Western Ghats. To give a clear and adequate idea of the plateaux and hills covered densely all over, by the beautiful green forests and the beautiful pellucid streams and rivulets running down them would be beyond my power.

On reaching Marmagoa we sailed off the channel to Punjim.

The journey from Punjim on to Ratnagiri was more of a touring than of instructive nature.

We halted at Punjim for two to three hours. During that time we took a round about the city. The capital is elegant and finely built, and has got specious and clean roads; the city—buildings are just after the style of Bombay. While leaving a pleasant tea party was given to us by Messrs. Hahn, Naik and Gokarn.

At 10 p. m. from here we launched for Ratnagiri.

Thus the final point of our tour was specially employed, as would be expected, in studying the rice crops and others of local interest. In particular we went to Mr. Joshi's well-known mango gardens where we were shown the mango grafts both simple and by approach—for which he is famed. This is, of course, one of the centres for the best mangoes in India. Mr. Joshi very kindly entertained us to tea.

This was our last stopping place. After a rough and unpleasant voyage we reached Bombay on the following day, and so back to Poona.

The Geological Tour of the F. Ag. Students

BY

G. D. Gupta.

"I am a part of all that I have seen." As the day arrived appointed for our tour, the happiest and most instructive item of the first year course, our eagerness grew stronger and stronger, so much so, that, without the least exaggeration, I may say that even the Land of Nod though most alluring, had lost all its charms to many of us for the night previous to our departure.

Only a word as to the 'why' about such tours. We might have gone through the most vivid and accurate description. We might have pored over various maps pictures and plans. Yet reality gives us a new impression and a new knowledge hardly obtainable otherwise. This is specially true in the case of Science of Geology, which, indeed, can hardly be learned in any other way.

In the present year, we left Poona in the early morning of October 9th. The route taken by us, and the places visited were almost the same as in previous years. As new-comers have always something

novel to tell and open fresh channels of observation or reflection, I have undertaken the task of giving a very brief account of our experiences during the fortnight when we were absent from headquarters.

Our first halt was at Gokak road where we arrived on the evening of our started day. On the following morning, after the arrival of our Principal, who as usual led us throughout, we started on our mission. Examining the sedimentary rocks, filling our bags with conglomerates, sandstones, grit etc. etc., we neared the famous Falls of Gokak. I fail to find words for describing the beauty of this place adequately. It is interesting to note in this connection, that the proprietors of the spinning and weaving Mills situated very near the Falls, are thinking of utilising the falls for the purpose of generating electric power to drive their mills. On our way back to our station quarters, we were entertained at a tea party by some of the members of the staff of these mills, for which our sincere thanks are due.

The day following we spent in Belgaum. There the chief rocks examined were high level laterite, and a number of peculiar conformations of the Deccan trap. It would not be out of place if I mention that at night on the station, we had the pleasure of seeing a very smart Indian boy of 8, speaking four different languages, including English, which he spoke pretty well. In no time, the boy grew familiar with all of us, and Dr. Mann too. We wish every success to our young friend.

Next came Castlerock. We walked along the railway line from this place to Dudhsagar over bridges and through various tunnels, examining and collecting shales, schists, gneiss, etc. Here the trip was very laborious, yet most pleasing and instructive. One could not look over the wonderous scenery in the way, with its legion peaks high and low, which seemed to welcome and join the celebrations of the fresh day, without naturally questioning, "who did all this colosal work?" Out of a mere huge mass of earth who chisselled these mighty picturesque objects? Oh! The answer was at hand. Lo! The real sculptor the dynamic force, always young, ever fresh and vigorous was rising up the Eastern horison. It was he who raised the water up which excavated these ravines. It was he who gave gravity a plough to open out the valleys by planting the glaciers on the mountain sides, and it was he who would ultimately roll away these works of its own

creation, in the mighty arms of ocean. The terminus of that day's trip, Dudhsagar Falls, were arrived at midday, where a soothing bath and drink really served the purpose of "Dudh."

On the morning of October 13th we found ourselves at Londa. Here our trip was along a stream, through a very thick thorny jungle. "In the free life, the fresh energy the sparkling transparence and merry music of smaller streams, there to something fascinating much more than the majestic grandeur of a river." No concealment, no melancholy there. Nature seemed to hold a never-ending festival and dance accompanied by the sunshine, shadow and running water.

The next place of inspection was Dharwar, where we saw only the Government farm. Here we had another entertainment by the Farm staff. The following—Sunday—was also passed here, where we enjoyed our well-earned rest. A grand feast was arranged, as our friends, the B. Ag. students, then on their Agricultural Tour, were also in Dharwar that day. Dr. Mann, Prof. Knight, Messrs. Gokhale and Sahasrabuddhe were present at the dinner arranged in honour of the occasion. Can it be a matter of little satisfaction to see the Indian youths, from all communities, brought up in the most various environments, taking dinner in the same place, with their Mohammedan, Christian and Parsee friends. In the evening a lecture on "What has the Agricultural Department done during last 10 years," was delivered by Dr. Mann in the High School Hall. Our Principal, in dealing with his subject in his usual masterly style remarked that he would think college successful, only when its graduates shall labour, through thick and thin, day and night, to further the cause of improved agriculture, otherwise the college is nothing but failure. What a magnificent piece of advice!

Gadag was arrived on 16th October morning. This was one of the most important places we inspected, from a Geological point of view. Limestones, sandstones, shale, quartz, gneiss, schists, of various types were profusely collected.

At Bagalkot, like our last year's friends, we had to cross the river Ghataprabha, in a strange sort of boat, a big basket with leather brimming all round. Geologically this day was of very great interest, the conglomeritic quartzites being very fine indeed, while we came across in an adjoining village the only large area of limestone seen during our tour.

Our last stay was at Bijapur, the city of antiquarian interest. Here we were again on the Deccan trap area, and certain peculiarities showed themselves. In particular the marked development of calcite was noticed. In the afternoon we went round the historic city. Among other things we saw the Gol Gumbat, a wonderful piece of architecture, Jumma Masjed, Ashar Mahal, Ibrahim Roza etc. as well as the Mulka-i-maidan gun, the dread of its times, which was lying resting in a corner of the ruined city wall along with her two sisters.

The night of 19th. Really a night worth recording and remembering. It was beautiful calm night shrouded by a canopy of darkness, when we all assembled to sing, dance and enjoy, under the leadership of our Principal. Be it known, to add to the various wild ways of nature, magnificent lightning was flashing "between gloom and glory." Every one of us was bound to sing, recite, dance or lecture. And why not? Who would not sing?

"That man that hath no music in himself,
"Nor is not moved with concord of sweet sound,
"Is fit for treasons, stratagems, and spoils."

Dr. Mann's song "sweet home" and Prof. Sahasrabuddhe's Gujerati song will never be obliterated from our memories. Dr. Mann, then, gave a fairly long lecture, full of meaning, advice and affection he feels for us.

Now the time for return came. A thorough love and true enjoyment of the journey does not by any means interfere with the love and charms of home. "Perhaps no one can enjoy thoroughly home, who does not sometimes wander away. They are like exertion and rest each the complement of other."

I would be guilty of gross mistake if I forget the troubles, which Dr. Mann and Prof. Sahasrabuddhe took merely for our sake. Both of them accompanied us wherever we went, in whatever we did, throughout the tour. On behalf of all my fellow brethren I tender our most sincere and grateful thanks to them.

Mr. G. D. Mehta.

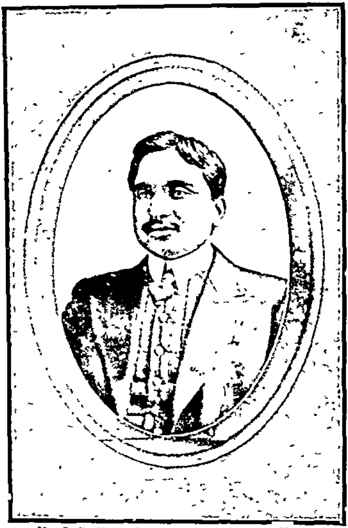
WE offer our heartiest congratulations to Mr. Ganpatlal Dayashankar Metha, L. Ag., (Bombay University), B. A. (Cantab), N. D. A., N. D. D., on his admission into the Imperial Indian Agricultural service. We cannot allow this occasion to pass without giving to our readers a short sketch of Mr. Mehta's life as he is the first graduate from an Indian agricultural college to be admitted into the Imperial service.

Mr. Ganpatlal Mehta was born in a wealthy *sawkar* family in May 1884, at Umreth, in the Kheda District of Gujerat. He completed his primary education at Nadiad. After passing his Previous Examination in 1901 he joined the Agricultural Branch of the College of Science in the beginning of 1902, and passed the L. Ag. Examination in the first class in 1904. He was the first student who obtained the first class in the L. Ag. Examination. In 1905 he obtained the Sir Mangaldas Nathubhai scholarship of the Bombay University and also a scholarship from the Bombay Government and proceeded to England to study Agriculture and specialise in Agricultural Chemistry. While in England he had a four years' course in Agriculture and Science at the Cambridge University and took the following Diplomas:—

- Agricultural Diploma in 1906.
- National Diploma of Agriculture in 1907.
- National Diploma of Dairying in 1908.
- Natural Science Tripos, Part II, Cambridge,
- First Class Honours with a Gold Medal in 1909—the highest distinction obtainable by a student in Chemistry at that University.

He also visited various seed stations in the United Kingdom and on the Continent, and made a special study of seed testing and seed selection.

When he returned to India in September 1909, the Government offered him a position in the Bombay Agricultural Department and recommended his name to the Government of India for admission into the Imperial service. Mr. Mehta's career both in India and at Cambridge has been a brilliant one, and we must congratulate the Government in having secured his services in a wider field than the Bombay Presidency alone offers.



Mr. G. D. Mehta L. Ag., B. A., N. D. D; N. D. A.

College News and Notes.

The present number of our Magazine issued on New Year's Day carries with it to our staff, fellow-students, and to all our subscribers our very sincere greetings and best wishes for a Happy New year. We trust the New Year will be one in which Heaven's blessings await us all.

To us, the students of the College, the New Year is a herald proclaiming from the house tops the decree. "The examinations approach. Be up and doing and ready for the fight." Indeed, to us the University examinations are all important in the first few months of the New Year. We hope that all our efforts in the old year will be crowned with success in the New and that we shall have the pleasure of seeing ourselves nearer the goal towards which we are striving.

For the Agricultural Department, we pray that the New Year may be more prosperous than the past; that Nature may ever wear a most radiant smile; and that our barns may be so filled with plenty that the delight born of hearty satisfaction and joy at nature's grace and bounty may be reflected in the countenance of every member of the department.

The most interesting item enacted at the College during the last quarter was the Social Gathering held on the 3rd of November which brought us—staff, students and ex-students all together, to enjoy in each other's genial company a useful and pleasant holiday.

The day was ushered in by the auspicious sounding of the "*chowghada*;" and well might the "*chowghada*" be called auspicious, for nothing whatever chanced to disturb the exquisite harmony of the day's proceedings. Even the heavens which a few weeks after bore ominous clouds, seemed to look kindly on our gaiety added to it by lending us bright sunshine and excellent weather.

Hence, the photo, the tennis match, and the various sports and games which formed the programme for the day were a decided success. Mr. Keatinge, our Director, before distributing the prizes and medals

to the several champions in the sports, addressed the assembly on the occasion in a very felicitous speech brimming with friendly and instructive advice. Dr. Mann had also a few words of advice to give, in his usual eloquent and effective style.

After the address which was at 4-30 p. m. we had an exciting time at Tug-of-War before adjourning to partake of refreshments. The S.Ag. men seem to be a powerful lot, though many appear to be otherwise; they pulled over the F. Ags. and the B. Ags. Their prowess however failed before the mighty strength of the staff, which, mighty in the lecture room, also vindicated its supremacy on the playground.

And here we might congratulate ourselves and feel proud of the intimate understanding between the professors of our college and its students. We doubt not that this makes us know and love each other more than anything else would. And we thank most sincerely all the members of the staff for conducing, not only by their presence but by their active interest in all items of the day, to the eminent success of our gathering.

We must also not forget the ex-students, some of whom came a long way to join us and others by their messages expressed their appreciation and wished success to our undertaking. To all of them we give hearty thanks for their co-operation.

At 8-30 p. m. commenced the variety entertainment. It opened with a fine march rendered by the orchestra composed of budding musicians from among the students and a few young men who did us the honour of strengthening our own band of musicians and to whom our best thanks are due for their charming performance on the violin and mandoline. The Nigger Minstrels, the Gujerati drama "Karma", the English farce "Cherry Bounce" and the Marathi Drama "Premadhwaja" rendering of the "Talisman" all helped to keep us lively and occasionally also serious. It was rather long after midnight before Dr. Mann rose to thank all concerned for the admirable arrangements that were made to bring about such a successful gathering and even then the stage clown seemed to be loth to allow the assembly to break up.

To Mr. V. N. Gokhale, the general secretary, and to all his under-secretaries we offer our hearty thanks and congratulations for all they did to enable us to have a most enjoyable gathering.

of eight lakhs of rupees. A large part of this donation is to go for vernacular agricultural education which we trust will soon spread by the opening of new vernacular agricultural schools.

We have great pleasure in thanking the manager of the Deccan Printing Works for presenting to our College, a portrait of Their Majesties. The picture is quite brilliant and as for its price of annas three it is very cheap.

The weather in November was unusually peculiar. The heavy rains towards the latter end of the month bore the appearance of a second monsoon. Though untimely and not of advantage to crops in flower, this rain has helped to soften the soil, do good to young dry crops, and improve the very short fodder supply.

The students have been away for the Christmas vacation while our pages were in press. We hope they have had a good time and will return fresh for the hard task before them.

We have much pleasure in noting the success in the recent B. Sc. examination of Mr. R. B. Vaidya a past graduate of our College; we wish him joy on his obtaining a new degree, and success in his work as science and nature study teacher in Berar.

We have pleasure in also recording that another of our past graduates, Mr. Maganlal Gokulbhai Desai, is to be shortly sent to England by H. H. the Gaikwad's government for special training in horticulture. We wish every success to him during his stay in the West.

The College Gymkhana.

Cricket has been at its ebb throughout the second term. Some enthusiasts recently memorialised the secretary and requested him to give facilities for daily practice at the nets. But though the secretary offered to make the necessary arrangement the sudden enthusiasm seems to have waned owing to the prospect of the examinations.

The Tennis secretary has had a lively time the past quarter, if the arranging of tournaments and settling the thousand and one knots that arise in consequence really deserve the name. He was indeed kept very busy particularly owing to the tournaments in connection with the Social Gathering. As Mr. Modak the veteran tennis champion decided not to play, there was room for others to shine in the tournament. The names of the several champions are given below.

The existence of only a single court creates many difficulties as most of the students like to indulge in the game. We would wish very much that the court on the college grounds be opened as soon as possible to facilitate matters.

Hockey still holds the lead and practices are often held. The last match played was on the 22nd of December against the Young Parsees. We lost it, but we are still younger in the game than the Young Parsees.

The Gymnasium has its usual patrons.

The Reading Room is well patronised particularly between lecture hours. The boy however seems to have a knack of removing the latest periodicals and retaining the oldest. He would do well to receive instructions from the secretary for maintaining better order in the arrangement of papers and periodicals.

The Debating Society has had to cancel several lectures owing to the many holidays. We had still some very interesting papers by Mr. Burns, Mr. R. K. Desai and Mr. C. V. Sane on Grape-Vine, Ginger, and Improvement of Indian Cattle respectively.

PRIZEMEN FOR 1911.

Champion Sportsman ... ... Mr. R. D'Souza.

CRICKET.

Batting ... ... Mr. S. B. Deshpande.
Bowling ... ... Mr. N. R. Gurjar.

TENNIS.

SENIOR SINGLES.

First champion ... ... Mr. H. K. Bendigiri.
Second champion ... ... Mr. S. Allabux.

SENIOR DOUBLES.

Champion ... ... Mr. H. K. Bendigiri.
Mr. C. M. Mugali.

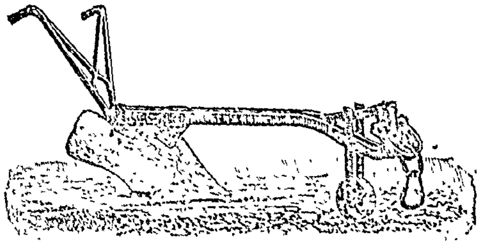
JUNIOR SINGLES.

First champion ... ... Mr. S. R. Godbole.
Second champion ... ... Mr. B. S. Patel.

JUNIOR DOUBLES.

Champion ... ... Mr. S. R. Godbole.
Mr. N. R. Gurjar.

Improved Agricultural Implements.



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" " " " 12	...	...		10-5-0
" " " " 13	...	...		8-0-0
Hand Chaff Cutter	...	...	...	10-5-0
Frictionless Roller Bearing Iron Pulley for Water-lifts	...	...	...	8-8-0

Models for the next season are now ready and embody substantial improvements over last year's.

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1st January 1912.

MARCH 1912. [No. 4

THE

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POONA

PRINTED AT THE "ARYA-BHUSHAN" PRESS, AND PUBLISHED AT POONA

By

Vishnu Narayan Gokhale

1912.

THE

POONA AGRICULTURAL COLLEGE MAGAZINE

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Notice to Contributors.

The Magazine is at the disposal of Professors, past and present students as well as outsiders having special interest in Agriculture. All contributions should be written legibly and on one side of the paper and are subject to such needful emendations as may be consistent with their ideas and rejected articles will not be returned.

The Magazine will be published as follows:—1st July, 1st October, 1st January, 1st March and contributors are requested to send in their contributions *at least one month before the date of publication.*

B. S. PATEL,
Editor,
POONA AGRICULTURAL COLLEGE MAGAZINE

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1912.

Price Rs. 9.

CONTENTS.

A Grand Prize

Rs. 500

FOR AN IMPROVED SEED-DRILL.

OFFERED BY

Dr. H. H. Mann,

Principal, Agricultural College, Poona.

HOW do you expect a good crop when the seed is sown haphazardly with a seed-drill, however thoroughly the land is prepared or manured?

Best Results can not be obtained by only good sound seeds of best germinating power and free from any admixture, but by dropping the seed with a *seed-drill which distributes the seed evenly and uniformly.*

Such conditions are not obtained in any tract of this Presidency. In Gujerath the sowing is straight in most of the tracts, but the uniform distribution of seed is seldom met with. A close inspection of the sown fields immediately after germination will reveal not less than twenty per cent. of the sown area in blank, without a single seedling. This state of things must certainly affect the out-turn. *This might be due to defective seed or seed-drill.* However expert a sower might be, it can never be expected that seeds will be dropped so regularly and evenly as by a machine. Being frequently struck with the present wasteful method of sowing *Dr. Mann has kindly offered a Prize of Rs.* 500 for an improved seed-drill.

The prize is to be awarded under the following conditions:—

1. The price of the seed-drill should not exceed Rs. 50, the less the better.
2. The drill should automatically sow the seed at regular intervals in and between the lines.
3. The blanks left by the drill should not exceed five per cent.
4. The seed drill should be suitable for all kinds of soils.
5. The drill must be able to sow small as well as large seeds.
6. The model seed drill should be a full sized one suitable for working in the fields.
7. The drills will be tested by a Committee consisting of Mr. P. C. Patil, Divisional Inspector of Agriculture C. D., Mr. M. L. Kulkarni, Divisional Inspector of Agriculture S. D., and Rao Saheb G. K. Kelkar, Assistant Pro. of Agriculture. The Committee may consult Prof. Knight and Mr. Main, if necessary.
8. The models of drills will be received by the Principal, Agricultural College, Poona, to the end of May 1912. In case drills of similar pattern are received from more than one person - preference will be given to the one that is first received.

All communications to be sent to the Principal, Agricultural College, Poona.

Prof J.B. Knight, M Sc

Professor of Agriculture

Prof W. Burns, B. Sc.

Professor of [illegible]

The Poona Agricultural College Magazine.

Editorial.

THE present number is the last of the third volume of the Poona Agricultural College Magazine and we close it with an expression of very gratitude to all who have assisted to make it the best volume which has yet been produced. It is larger than either of the previous ones; it contains more illustrations; and the quality of the articles will be found on the whole of quite as high a standard as before. As a result, the circulation is constantly increasing and we have now subscribers in practically every part of India, while copies go regularly not only to England, but also to the continent of Europe and America. The editors, in laying down their duties, would thank all the members of the college staff, and of the staff of the agricultural department, as well as past students, students and outsiders for their very hearty co-operation in making the Magazine the success it has been during the past year.

In the present number will be found several articles of considerable interest. We would in the first place call attention to the article by Mr. S. D. Navalkar on the reclamation of lands under high tide water on the West coast of India. The matter is an important one; much money has been spent in reclaiming coast mangrove covered land on the West coast; many failures have been made and a few successes. The actual record of a successful instance of this work, with the accounts for the same, is bound to be of value, and of great interest.

We commend also to the notice of our readers, the article by Mr. G. D. Mehta on Seed-testing, inasmuch as the author is an expert on the subject, and has been applying his knowledge during the last three years to the study of the actual seed conditions in our province. His results are striking in two directions. The seed used by the cultivators is not nearly so bad as many writers have made out, except in the case of

cotton. Cotton seed is, however, worse than anyone would have even dared to predict, and its present condition would certainly seem to demand very serious thought and action on the part of those in a position to remedy the actual state of affairs. On the other hand, the seed of most crops is not nearly so good as it might be or as it ought to be.

There are many special kinds of cultivation in the Bombay Presidency about which little information is on record, and any detailed description from local knowledge is of great value. We have published articles on some of these in the past. The growth of 'Betel-vine' in several centres has been described in our columns; the method of producing the dried plantains at Agashi in the Thana District has been treated of, and there are several other cases. In the present number two such articles are given. One, by Mr. R. K. Desai, whose home is near the spot which he describes, is on *Lendi pipar* (*Pipar longum*) cultivation as practised in the Surat district; the other by Mr. R. D. Khandekar, is on *ganja* cultivation, that is to say hemp cultivation for the production of the intoxicating drug, near the town of Ahmednagar. Both of these will be found of more than ordinary interest.

It may be worth while also to call attention to Dr. Mann's article on the manufacture of agricultural implements in Western India. This was originally written for one of the Bombay Engineering papers, and contains a short account of the works which have been successfully established and developed by Messrs. Kirloskar Bros at Kundal Road (S. M. Ry) for the manufacture of agricultural implements, especially chaff cutters, ploughs, and similar things. We hope that the works described by Dr. Mann will develope enormously in the coming years, and that they will be the pioneers of a very successful manufacture of improved implements in this part of the country.

And now we send forth the last part of the third volume of our Magazine. When it issues from the press many of the college students will be away, the college will have broken up for a time, and another college year will be over. Many among the students will have left the doors of the institution, as students, for ever; we hope that this will not prevent them thinking of it as their *alma mater* and visiting it whenever they are near enough to do so. They are always assured of a hearty welcome. Our students only belong to us the more when their college days are over. It belongs to them to carry the college spirit into every corner of India. So may it be.

The Department of Agriculture of Bombay During the Last Ten Years

BY

S. V. Nagarkar,
DHARWAR.

[The following note written by a friend at Dharwar will, we believe, interest our readers—Eds]

DR. H.H. Mann, the Principal of the Poona Agricultural College has been having his annual tour through Southern Maratha Country. In his tour he was accompanied by forty-one of his pupils. The object of this tour is to give to these pupils a close and intimate knowledge of the construction, nature and the properties of the various kinds of rocks, stones and soils of these parts of the country. About the same time last year also Dr. Mann passed through Dharwar with a similar batch of students. This year he had already visited Belgaum, Londha, Castlerock; and from Dharwar he proceeds to Hubli, Gadag, Bijapur and other points. As last year during his brief stay he delivered a most interesting address on the evening of Sunday the 15th October 1911 in the hall of the local Government High School the topic of the address being "The work of the Bombay Agricultural Department during the last ten years." The address was presided over by the Collector of Dharwar, Mr. E. Maconochie, and attended by quite a representative gathering of the citizens of Dharwar.

Dr. Mann, in substance, said that within the last decade the conditions of agriculture in India had undergone, he could not say radical changes, but he could certainly say considerable changes at least in Bombay Presidency. These changes were as significant in themselves as they were prophetic of the still greater changes that are to follow. It was strange that in a country like India where 80 % of the population were dependent for their daily living on agricultural pursuits, agriculture and agriculturists should have been considered some thirty years ago, as they are even to-day in some quarters, as being below the dignity of a gentleman either to follow or to associate with. This frame of the popular mind in this country received its

first rude shock in this part of India perhaps in the great famine of 1877 when the eyes of both the Government and the people were directed towards ascertaining the cause of and averting the evils arising from that widespread calamity. It required long and deep thought on the part of the Government to devise ways and means, even if tentative, for the purpose of improving the condition of Indian agriculture and Indian agriculturists. When the Government came to apply these ways and means in a practical way to the solution of great problem it had to face several very great difficulties. The chief of these difficulties were (1) lack of interest, (2) lack of knowledge and (3) lack of men.

(1) By lack of interest is meant the fact that the really intelligent and thoughtful people did not, and would not take any the least interest in agriculture. They were confirmed in their solid belief that ploughing and farming were concerns of the ignorant ryot and that they as superior beings were in no way concerned with them.

(2) By lack of knowledge is meant that under the conditions prevalent, one part of a District did not know and did not care to know anything of the modes and methods of farming that were being followed in another part of the same district, and still more of the improvements which had been devised either in or out of India. Furthermore, the best methods meeting the existing special difficulties were quite unknown even to the best cultivators any where, and demanded experiments long continued in order to find them.

(3) By lack of men is meant that at that time there were no educated men who would be willing to devote themselves to the work of improving agriculture of the country. The people of the so-called higher classes in this country have a horror of all manual labour and the greatest horror of a close and direct contact with anything like the soil in the fields and the mud in the mines.

At this point in his address Dr. Mann said that if any one asked him as to what had been done by the Agricultural Department to remove these untoward conditions he was not in a position to claim that much had been done. All the same no one could deny that a beginning had been made and that at least a little had been accomplished. That the lack of interest was passing away, though not as fast as one would wish, was evident from the class of people that had taken the trouble of coming to hear him in a purely agricultural subject. It

was a matter of unfeigned satisfaction to him to notice among his hearers that evening quite a number of lawyers, doctors, schoolmasters and merchants; and he sincerely believed that not a few of them had come there to hear him from a genuine love of the subject. This same public interest has been materially stimulated by the establishment of Agricultural Associations and Co-operative Credit Societies in different parts of the Presidency by the starting and maintaining of monthly magazines and by the distribution of leaflets and other literature devoted to various topics in connection with agriculture.

Coming to the second question of the lack of knowledge, the lecturer said that mere interest without knowledge would be next to useless. With a view to acquire such a knowledge the Agricultural Department has been busy in investigating the nature of the soils of different districts and the methods followed in the growing of the different crops in various districts of the Presidency. It is of the utmost importance to find out first of all whether the method followed in the growing of any one particular crop in one Taluka would be suitable to the growing of the same crop in another Taluka. On inquiry it has often been found that such a method followed in one area is used no where else, or if it is followed in another place, this is done without any attempt to adapt it to the new conditions.

Dr. Mann said that it was principally for the purpose of arousing such an interest in the minds of the people in general and of the agriculturists in particular that Government had established its own Farms in several Districts. Such farms are often called "Model Farms". Personally he had the strongest possible dislike to the term 'Model Farm' he would rather call them experimental farms. For after all what the Agricultural Department was trying to do through these farms was to find out what was the best thing to do. Was it the best to try to raise such and such a crop in such and such a soil? If not what other crop would be suitable? And, in any case, how could it best be done,—and most profitably? These and similar questions they were trying to solve on Government Farms. They were trying to find out what was the best thing to do to-day. Next year or ten years hence under the light of new discoveries and new investigations the same thing may not be the best.

Given a particular kind of soil on these experimental farms it was tested and found out as to what kind of crop would grow most profitably

in such a soil and under such conditions. The soil round about Dharwar, Hubli and Bankapur for instance, is well suited for the cultivation of Broach cotton and therefore that particular kind is recommended to be grown in these parts. Within the last two years this cotton crop brought fifty thousand rupees extra to the cultivators of cotton in these Talukas. People often asked why Egyptian cotton was not grown. They might just as well ask why Sea Island cotton was not grown. The answer to such questions is simple and plain. These varieties are not grown simply because they cannot be grown in these parts, and the Government farm at Dharwar has proved it.

Speaking of the lack of men Dr. Mann said that as in every field of reform in the improvement and advancement of Indian agriculture also there is great need of the right kind of men—men of character, men of self-denial and men of devotion to duty. Men of ordinary official type who go through their daily routine of duties would not be of any use in the agricultural department. Here a man must be endowed and imbued with deep enthusiasm and must be prepared to take up agriculture as his life work. The lecturer pointed Mr. M. L. Kulkarni the present Divisional Inspector of Agriculture as a man of marked devotion to his vocation, and said that there were a few others also like Mr. Kulkarni in the Agricultural Department. But, all the same, more of this type were still needed. More than in any other Department, it is in this one that workers have to learn ever to be disappointed. They have also to learn how to be patient under very bitter and sever criticism.

After this the lecturer went on to explain what has been accomplished by the Agricultural Department within the last 10 years. What were the improvements introduced. These perhaps were not many. But it is the first step that counts and is the biggest. The second is comparatively easy. Speaking of the Dharwar District so well noted for its cotton cultivation the lecturer said that Agricultura Department had not only demonstrated the possibility of growing Broach cotton in the black soil of this District, but it had won a permanent popularity to this particular species of cotton that possesses decidedly a larger ginning percentage over the Local Kumpta cotton. Taking into consideration the fact that the Indian agriculturist is so deeply waded to his old ways and ancient methods it is most gratifying to note that in the course of last year alone 50000 lbs. of Broach cotton seed was sold to the cotton cultivators of this district. And while all this was done

for the outside Broach cotton, the local variety of Kumpta cotton had not been neglected but, on the contrary, had been greatly improved.

Then again take the case of groundnut. There was a time when in those parts some 20,000 acres of land used to be under the cultivation of groundnuts. But some fifteen years ago the type was found to be ruined by disease, and so the cultivation declined. Upon this, the argicultural department collected all the possible varieties of groundnuts, from various parts of India, and also from Spain, Japan and Egypt and from these selected a new type. And at this date in the Belgaum and Satara Districts as well as in the states of Ichalkaranji and Kolhapur, the Spanish and the Japan types of groundnuts are found to be flourishing, and their cultivation is rapidly extending. This is highly significant when one takes into consideration the fact that oil-seeds of every kind are every year growing in value and are found to grow in value in the immediate future.

Then again especially round about Poona, sugar-cane growing has been brought to such a perfection that it is all almost as good as anywhere in the world except perhaps in the Sandwich Isles in the North Pacific.

Speaking of the improvements effected in agricultural implements the lecturer said, these improvements can never be over estimated. The myth that the old Indian plough was good enough simply because farmers had been working with it from the most ancient of times, has been more than exploded. If any one needs the proof of this he can interpreto the facts for himself and note that 2000 ploughs of a foreign make and several thousand manufactured by Messrs. Kirloskar Bros. of Belgaum on an improved plan have been sold. So also there is the new French gear plough lately imported which bids fair to find favour with Indian land-owners. The same is true of the improved furnace for boiling sugar-cane juice lately devised by Mr. P.C. Patil, Divisional Inspector of Agriculture, C. D. In the early stage of his enterprise Mr. Patil was quite despondent of success but now to his own as well as to his customers' great gratification, there is a very great demand for his furnace in the jaggery manufacturing district round Satara.

Dr. Mann said that one of the great needs in the way of implement in this part of India is an effective seed-drill that is, a machine for secur-

ing an even sowing of seed. According to the method at present in vogue among farmers the seed is so unevently distributed in the field that in some places it is very thickly spread while in other places it is very thinly scattered. What is needed is a machine that would enable the farmers to distribute the seed evenly in the seed furrows. Dr. Mann is prepared to award a prize of Rs. 500 to any one who would devise such a mechanism, suited to the conditions of the Deccan and Southern Maratha Country.

It is a notorious fact that round about Belgaum grass-hoppers are a great pest to rice crops in their very tender stage. These creature. have long been the despair of enterprising rice cultivators. With a view to do away with this pest, the Agricultural Department has lately devised a kind of net which, if swept over the paddy field, collects into itself vast swarms of grass hoppers that can ultimately be buried in a pit previously dug for them. It is only just to mention that were it not for this device for the purpose of destroying grass-hoppers the paddy cultivators of Belgaum would not in some years able to reap a crop of even two annas in the rupee.

The lecturer spoke for over an hour and a quarter, and was heard with rapt attention. At the close of the lecture the President on behalf of the audience heartily thanked the lecturer.

Silage in Western India

BY

W. Horn, Esq
Manager, Civil Dairy, Poona.

SILAGE or Ensilage, is a preserved fodder, in which the, succulence or natural juices have been retained, and is prepared in pit or "Silo".

The advantages of silage are many, the chief being :—

1. Palatability.
2. Succulence.

3. It can be prepared during the rains when green fodder is plentiful and held over till the dry season, when green succulent fodder would be impossible except in irrigated tracts.

4. It can be filled into pits without regard to weather conditions and at times when the drying of grass or *kadbi* is impossible.

5. Coarse grasses and weeds which would be refused in their natural state are eaten readily if made into silage.

6. After being pitted there is no danger from fire etc. as is the case with dry fodder.

7. It is most useful to feed in the case of sudden outbreaks of Epizootic diseases, when it is a splendid alterative.

8. The cost of production is cheaper than that of dry fodder and the wastage less in proportion.

Silage can be prepared from almost any green plant, but the quality of the fodder taken out must depend upon that put in, and although weeds etc. which in their natural state are refused by cattle, may be even greedily eaten, after being converted into silage, they are still weeds and have not gained in feeding value, but have simply been made palatable.

The crops usually selected for silage are :—Maize, jowars (*of the non-saccharine varieties*), grass, wheat, barley, oats, lucerne &c. Of these Maize is undoubtedly the best, and it should be noted, that under ordinary conditions, all plants which have a hollow stem are not very suited for the " soil ". silo "

There are two chief classes of silage *viz.* 'Sweet silage' and 'sour silage' and the class which will be produced depends upon the state of maturity of the crop at the time of cutting. In the case of the crop being cut too early while it is very immature and contains a high percentage of moisture, fermentation will be excessive, large quantities of acid will be produced, and the silage will be sour, and sweet silage will be produced by using well matured crops for the silo.

" Sour silage " will also be produced by using the varieties of jowar containing a large quantity of sugar, as the sugar will under fermentation be converted to acid. It is therefore evident that jowars of

these varieties can be more profitably fed green, when the sugar (which is of high feeding value) will be utilized, while if put in the silo, this will be completely lost as the acid which will be produced, has little feeding value.

The importance of selecting the right time for cutting, will be more noticeable in the case of maize, than with any other crop.

The time for cutting maize is when it has reached full maturity, as chemical analysis shows that it almost doubles in feeding value, between full growth (tasselled) and maturity. So it is very evident that to cut before maturity means a heavy loss, further, the maize plant in its earlier stages contains a high percentage of sugar which as the plant matures, becomes gradually changed to starch, until at the time it has reached maturity the sugar has practically disappeared. It is therefore evident, that it is of the greatest importance to only put mature maize into the silo, as if immature maize is put, in the sugar is lost, while if kept till mature the starch will remain unaffected by the fermentation and is of high feeding value. The following analysis of good maize ensilage shows the starch under carbohydrates which it will be noted are very high and only require the addition of food rich in proteid to make a balanced ration.

Water	... 79·0 p. c.
Proteids	... 1·2 p. c.
Soluble Carbohydrates ...	... 11·8 p. c.
Ether Extract (Fat &c.)	... ·6 p. c.

The classes of silos are many *viz.* cement concrete, masonry, brick, wood etc. made in many shapes and sizes, or the silo may simply be a hole dug in the ground in which the fodder is buried by covering it with the earth removed from the hole. Whatever may be the construction or style, the object is the same, *viz.*, to get the fodder into a compact mass, and after it is once filled, to rigidly exclude air and moisture. This result is best obtained by using a circular shaped 'silo' of good depth, say 30 feet or more, the sides of which should be perfectly perpendicular and smooth. The material used in construction is a matter of locality and economy, as the silage will not be influenced by it. Good silage can also be made by burying the fodder in a pit dug in the ground which has the advantage of costing nothing for construction, but of course, there will be a rather large amount of wastage by this

method, as so much fodder will come in contact with the earth and be spoiled. It is also not possible to chaff the fodder into such a pit, as can be done in the case of a *pukka* built silo. In spite of its disadvantages however, this is the system which will most probably be adopted in India, owing to its low initial cost, *viz.* Rs. 5 to 10 according to cost of labour for digging.

The size of the pit will be governed by the quantity of fodder available and the number of cattle to be fed, but in actual practice it has been found that a pit 30 feet long, 12 feet wide and 6 feet deep is most convenient when other conditions will admit of this size being used.

The site selected for the pit should be the highest portion of the field to prevent the percolation of water, and while digging, the earth should be kept well away from the edges (say about three feet) to prevent it from falling in the pit while the fodder is being put in. When the fodder is ready, cutting and putting may be commenced without regard to the weather as even heavy rains falling on the fodder at this time will have no bad effect The pit may be filled quickly or slowly as may be convenient, but care must be taken that the fodder is well packed especially at the corners so as not to leave hollows for the accumulation of air. Care should also be taken after the fodder has come above the ground level, to keep the sides perfectly perpendicular, to allow it to settle evenly.

The filling should continue until the fodder has reached the same height above the ground, as below the ground, which in a pit of the dimension here given, would be six feet above and six feet below ground. When this height is reached the top should be sloped off in the form of a ridge to shoot off the rain water, and then covering with earth may commence. This should be commenced from the bottom gradually building the earth up round the sides and ends until the whole is covered and it should be noted that the whole of the earth removed from the pit, should be used in covering, as this will give the necessary pressure to make the silage settle compactly. After the covering is complete the mass will gradually settle until the top portion of the fodder is level with the ground line and during this process of settling care must be taken to fill up all fissures or cracks, which would admit air or moisture, the admission of either of which would now cause

great loss. The top should be well sloped and a drain made round the pit to ensure all water being rapidly conveyed away from the immediate vicinity of the "silo."

The pit may be opened at any time the fodder is required, and can be kept for years if necessary, which suggests a means of making a cheap provision of good fodder as a stand by in the case of fodder famines. It is advisable to only open one end of the pit and to remove the contents straight to the bottom before removing more earth and this can be best effected by cutting the silage out in solid blocks with a hay knife. Rain falling on silage at this time will quickly make it uneatable, and it should also be protected from the sun, in fact the best results will be obtained if the fodder is taken straight from the pit to the cattle which are to consume it. This fodder may be fed to all kinds of cattle and sheep, except perhaps horses for which it does not appear *to be suitable as it has a too stimulatively effect on their kidneys. It* may be fed freely, but in the case of working bullocks or milking cows, it is advisable to give a little dry roughage in addition, say eight to ten pounds per head. Cattle unused to this fodder may not take to it the first day or two and it should therefore be fed for a day or two in small quantities but after this period the cattle will eat it greedily.

In the case of milking cattle it will found to stimulate milk secretion, but should not be fed immediately before milking, as the milk quickly takes up odours, and the particles of silage lying about would most likely impart their odour to the milk.

A pit of the dimensions given *viz.* 30 feet, by 12 feet, by 6 feet would give an outturn of about 80,000 pounds of silage. The loss of converting green fodder to silage will vary from 10 % to 35 % and will depend upon the stage of maturity of the crop, the class of silo, and the care exercised in handling. Good "sweet silage" should be of a bright greenish-brown colour and have a distinctive odour which it is difficult to describe. Sour silage will have a good colour and will be at once recognised by its rank acid odour. Silage which has thorough careless handling, or the admission of air and moisture, gone bad will be easily distinguished by its mouldy appearance and smell which is similar to that of rotting cow dung.

Lindi Pipar (Pipar Longum) Cultivation Near Gandevi

BY

R. K. Desai.

THE intensive cultivation of long pepper is one of the peculiarities of certain villages in Gujarat, and a description of the methods adopted in one of the villages of the Surat District may not be without interest. As is well known the plant belongs to the natural order Piperaceæ; it is, like other commercial peppers, a vine, and is very closely related not only to ordinary pepper, but also to the *betel* vine (Pipar betel) or *pan* one of the characteristic garden crops of India.

Climatic conditions:—The temperature of Surat varies from 40° F. to 114° F. and the villages in which this cultivation is carried on are situated at a distance of twenty-five miles south of Surat City. The rainfall varies from 40 to 50 inches, and almost all the rain-falls between the tenth of June and the end of September. There is, in fact, only rain during the south-west monsoon and very little falls at other times of the year.

Soil conditions:—The *lindi pipar* fruits, as has already been indicated, are borne on creepers. These creepers grow in *Gorat* and *Bagayat* soils very luxuriently, and moderately well in black soils. They do not grow in *girayat* and rice lands. The characteristic of the two first mentioned types of soil (*Gorat* and *Bagayat*) is that they are naturally well drained, have a very high degree of tilth and are very rich in plant food.

The creepers grow in places where tree shade is well developed. They are, thus found growing under the shades of mango and jack-fruit, but they do not grow under the shades of *babul*, *tamarind* and *Mahuda* trees. The creepers grow better in south side of the trees than otherwise.

Preparatory tillage:—The soil is first cleared of vegetation and is then dug out to a depth of six inches with a hand-spade in the month of

April or May. After this no further digging occurs. when a fall of eight to ten inches of rain has occurred, the creepers are planted out at the beginning of the month of August.

Method of propagation.—The creepers are planted into shallow furrows each about two inches deep made by a spade. The creepers are laid flat in the furrows and covered with soil till the whole is again level. Young creepers are preferred to old ones. About fifteen hundred pounds of green creepers in weight are required for the plantation of one acre. Their price varies from Rs. 4 to 5 per forty lbs. (green weight). The roots which develope from the nodes of the planted creepers get a firm hold of the soil after a *fortnight*. When the monsoon is over in October, one watering is given to the crop; the charges for this being Rs. 13 per acre. A fortnight after this leaves which have fallen from mango trees, or the dried leaves of sugarcane are spread over the creepers. Any sort of leaves may be used but these are the ones available in these areas. Thus the creepers are kept covered throughout winter and summer *i. e.* from October to May following. In summer, that is to say in April and May a number of vacant places appear in the planted vines and these are filled up with new creepers taken out of the existing vines near by. Much loss of creepers takes place during the hot weather, more particularly among those which are several years old, on account, apparently, of the excessive heat, and, similarly, much loss is experienced when the rainfall in the monsoon is deficient, among old vines. If proper care is taken in covering the creepers and watering, the same plantation may continue for a long period. When once the cultivation of the crop is established, in fact the cultivators have no need to buy creepers to fill up the gaps because they obtain such as are necessary from their own plantation.

At the end of May, that is to say, in Rohini Nakshatra, another watering is given and as a result, the creepers put forth new shoots just before the first showers of the monsoon rain. Such creepers are able to take the greatest advantage of the rain and grow with double vigour. The charges for this watering are also Rs. 13. Watering is given from a well 25 to 27 feet deep with a mhot having a capacity of thirty-five gallons. Four days are required for watering one acre.

Weeding is not done very regularly with this crop.

During the rains, usually, the land is weeded four times, the whole costing Rs. 5.

From the end of July or the beginning of August of the second year from the original planting of the *lindi pipar* garden, the creepers begin to flower. In the beginning very small yellow flowers are seen on each branch of the creeper. They are from seven to nine in number. Then from these yellow flowers, greenish yellow fruits are formed, and later on the latter become dark green in colour. The maximum length of a fruit is one inch and the minimum from one half to three quarters of an inch. When the fruits are dark green and fully matured, they acquire a pungent and sweet taste which indicates the time for picking the fruits. All fruits are ready for picking at very nearly the same time and are generally picked together. The picking operation is performed by women, boys and girls, ten years old and upwards, with the hands.

A few fruits are usually obtained in the first year, very shortly after planting, if the rainfall is good.

The picking charges for forty pounds are four annas.

Outturn :—The outturn per acre varies according to the condition of the crop. In a first class crop the yield per acre is 2250 lbs. (green weight). The moderate crop would give 1875 lbs. (green weight). The poor crop would amount to 1500 lbs. (green weight). The price for forty pounds of green weight varies from Rs. 5 to Rs. 8.

After-treatment of the Picked fruits :—From these fruits two sorts of pipar are made : (1) salt *lindi pipar*, (2) dry *lindi pipar*.

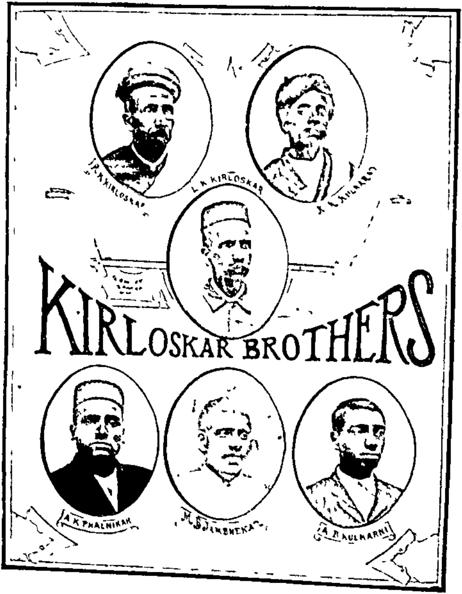
Preparation of salt Pipar :—When the fruits are picked and brought home, they are well-mixed with common salt in the proportion *of 15 lbs. of common salt to 40 lbs. (green weight) of the* fruits. Then after this, the mixture is put in an iron pan 4 to 5 feet high, 1 foot broad at the bottom and 3 feet broad at the mouth. It is generally open at the mouth. In this, the mixture of salt and fruits is kept for a week by which time plenty of salt water is formed in the pan. After a week the pipar fruits are taken out and are dried completely in the sun for one day. The fruits are often turned with the hand during the time of drying. When they are dried fully, the resulting product is salt pipar. Twenty-five pounds are produced from forty pounds of green fruits with fifteen pounds of salt, while at the same time much of the

salt water is left in the pan and can be used for another lot of fruits, and so on. The price for 40 lbs. of salt pipar prepared as above is Rs. 13 to Rs. 15 but varies very much.

Preparation of dry lindi pipar:—The green *pipars* are dried for four days continuously in the sun and while drying they are turned with the hands. When they are fully dried, about eight pounds remain from the original forty pounds of green weight. The price of this sort of pipar varies from Rs. 35 to Rs. 40 for forty pounds of dry weight, but this also is very variable.

These two sorts of *pipar* are then despatched to Bombay or Ahmedabad for sale. If the rates are very high, the brokers dealing with this business come down to the places of cultivation and purchase them in lots. The cultivators sell their produce to local merchants at the rate of Rs. 5 to Rs. 8 for 40 lbs. of green weight because they being short of capital, cannot afford to sell directly to outside merchants. The local merchants prepare the two sorts as mentioned above. These fruits are used as medicinal drugs and are sent all over the country from Bombay and Ahmedabad.

Remarks:—There is no doubt that this cultivation is a very profitable one. It requires no special and difficult treatment like pruning etc. Also it does not require manuring. One peculiar thing about it is this, that the crop grows in waste lands under the trees where no other crop is taken, but some shade is absolutely required.



Messrs—KIRLOSKAR BROTHERS,

Prominent members of the Firm.

The Manufacture of Agricultural Implements in Western India

BY

Harold H. Mann, D. Sc.
Principal, Agricultural College, Poona.

At the present moment there is a little doubt that after many years the spirit of progress has been roused in the rural districts in Western India, and one of the first directions in which this is manifested is that of a demand for agricultural implements of a more efficient type, capable of doing more work than those at present in use, and of saving some of the waste which now occurs. I want, in the present article, to direct attention to this matter, to indicate some of the conditions under which the field can be entered successfully, and by a short account of one of the local firms which is successfully producing what is wanted, to show some of the requirements which must be met.

The improvement of the agricultural implements in use here has been beset by several difficulties. The first of these is, no doubt, the fact that the foreign makers have rarely, if ever, studied the local requirements, and the variations in the local requirements, to suit small changes in conditions. Possibly they have never been in a position to do so, but the fact remains that the country-side is full of imported implements and machinery which has never been successfully worked, or if it has been employed for a short time, has been put out of court by some break-down which could not be remedied on the spot. The second difficulty which has rarely been met has been the relatively expensive character of modern implements. If you ask a man to replace a plough, for instance, costing five rupees, which he can make and repair in his own village, by one costing fifty rupees, you must show that the more expensive implement is exactly adapted to his needs, is immeasureably more efficient, can be repaired with at least equal ease, and even then you will find, and rightly so, that a small cultivator, to whom fifty rupees is a fortune, will hesitate long before investing in the new implement. The third difficulty is that of repair. It is hard to conceive the isolation of an Indian village. If the village blacksmith cannot repair an implement, it probably lies useless. Any one capable of dealing with the trouble is probably fifty or a hundred miles off, and the result is that the implement is laid aside, and simply rust away.

And yet, in spite of this, I want to combat the idea that our cultivators of Western India are so hopelessly conservative that there is no chance of progress, and modern methods have no chance. Very much otherwise. With all the hesitation, and the right hesitation, that is felt towards new introductions, there is a very strong desire for more efficient and effective implements among the more advanced cultivators in almost every part of the Bombay Presidency, and when an introduction is made which meets the conditions, then it is taken up, and often with remarkable rapidity.

Among new implements, which when provided and proved, will be in extensive demand are the following :—

1. An iron turnover plough.—This need has been very largely met, after much experiment, by two or three types of plough made both in Europe and America, and now, as I shall show later, locally also. The European plough which has best met the cultivators' need in the medium and heavy black soil tracts of the Deccan is the C. T. 2 plough of Messrs. Ransomes Sims & Jefferies of Ipswich costing forty rupees in Bombay, and this may very well be considered as a basis for further development to suit more closely the local conditions. This plough and its adaptations, such as that made by Kirloskar Bros. mentioned below, has already been sold by thousands, and can now be seen in use in almost every district of the Deccan.

2. A seed-drill within the means of and suitable to the needs of the cultivators.—None that I have seen have yet met the need of the conditions, and yet the need is very great indeed. The drill in use at present, while very cheap and very ingenious, is extremely inefficient and leaves, even in the best of cases, about twenty per cent of the land unsown.

3. A clod crusher.—This is badly needed in the very heavy black soil tracts of Western India. There is a Norwegian instrument which does the work very well, but it is too expensive, and the local implements are not powerful enough to deal with the extremely hard material found in the areas metioned.

4. Implements for inter-cultivation of crops.—Some of the country articles are quite good, but the demand which, implements of the

"planet-junior" type for cultivation, have received are sufficient to indicate that there is plenty of room for business if the proper articles are supplied.

5. Implements for preparing fodder.—A chaff-cutter for use here must be extremely simple and extremely cheap,—and these have in the last five years been locally produced in large numbers.

6. Implements for water raising, more particularly in connection with wells on which *mhots* are used.—No system of water raising, suitable to these wells, from twenty to fifty feet deep, has yet been devised which is more economical than the *mhot*. It remains, therefore to improve this, to replace the leather of which the bag is made by some more durable material, to obtain pulleys which work with less friction &c. This has partially been done by the introduction, after many failures, of a satisfactory iron *mhot* which is slowly winning its way, and a well made iron pulley, and other improvements.

These are, I believe, the most important implements for which a demand exists or is likely to arise as soon as the proper implement is provided. Some of them are already imported, but those imported always are apt to suffer from the already quoted difficulty of repair, and from the fact that they are foreign. This fact prevents the designer from hearing the criticisms of the users under our Indian conditions. This will be only got over when we have local firms who actually enter as manufacturers into the implement trade, and make efforts to keep in touch with the users and benefit by their criticisms. That there is an opening for such firms is indicated by the history of the firm of Messrs. Kirloskar Bros. of Kundal Road (Satara) on the Southern Maratha Railway. This firm, though still small, has entirely risen to its present position since 1905, and is still developing with considerable rapidity.

Its founder, Mr. L. K. Kirloskar, was an old tutor and teacher in the Victoria Technical Institute, Bombay. After leaving there he went in for manufacturing and repairing bicycles, first in Bombay and afterwards in Belgaum. In 1905 it was suggested to him that there was a good business field in making chaff-cutters of a simple type, and on this basis the present firm has risen. The kind of chaff-cutter made, received a very considerable welcome from the cultivators in the Southern

Maratha Country, and in the following year turnover ploughs, adapted from that made by Ransome Sims & Jefferies (previously referred to) were manufactured, and from that time development has been continuous, as the following figures will show :—

	Hands employed.	Number manufactured and sold.		
		Chaff-cutters	Ploughs.	Roller-bearing pulleys for water-lifts.
1905	7	—	—	—
1906	no record.	225	2	—
1907	18	515	45	—
1908	40	641	183	—
1909	60	274	237	53
1910	70	201	527	38
1911	85	234	906	263

In June 1910 the firm had to move from Belgaum, as the land on which their factory stood was required for the extension of the cantonement. A site was offered to them in the heart of the Krishna valley—the most richly cultivated tract in the Deccan by the chief of Aundh (through his Karbhari, Khan Bahadur J. B. Israel),—near Kundal Road Station (S. M. R.), and there a model village is being developed round the factory. The place is run on modern factory lines, the benefit of the workers is very largely considered, free medical help and free quarters being provided for them and their families,—and a regular savings banks system run for them by the firm. Their co-operation is secured by the constant offer of prizes for valuable suggestions, and a number of improvements have been introduced in this way into the implements made by the firm.

The implements already made are only a beginning. Corn shellers are made in fair numbers and other small implements also. The latest development is in making cart wheels, with turned cast-iron hubs and turned steel axles. For these there is a very good demand, at any rate in the Krishna Valley.

I have described the firm of Kirloskar Brothers because they have proved the demand which exists, and the opportunities which there are for the development of the trade in agricultural implements in Western India. I believe they are only pioneers; many others will follow in their steps. The day when improved implements were scoffed at, is past and if the proper article is devised and produced, at as cheap a rate as possible, and with due regard to the local conditions in which they have to be worked, there is a market of considerable size practically at our doors.

Ganja Cultivation in the Ahmednagar District

BY

R. D. Khandekar.

DURING a recent trip in connection with the college agricultural tour we went to see the well know garden owned and managed by Mr. Cursetjee. In this garden, many garden crops and fruit trees were grown, the chief of them being, *ganja* (hemp), sugarcane, mangoes, *Ludi* and *santra* oranges. The largest part of the area (about sixteen acres) was occupied by *ganja*, and I propose in the present article to describe the little information I have got about it.

The name '*ganja*' is given to the inflorescence of the female plants. Special care is taken to keep the ovaries unfertilized as the

fertilization of the ovaries leads to the formation of seed and renders the inflorescence unfit for the manufacture of ganja.

The conditions under which the cultivation is carried on at Ahmednagar are as follows :—

Rainfall:—The rainfall does not exceed twenty inches per year and this, I was told, is quite sufficient for the growing of *ganja*. In case the rainfall is deficient, one or two waterings at the most are given. One watering is however considered essential at the time of harvesting as it promotes stickiness in the leaves, which much increases the value.

Soil :—Deep black or medium black soil which is retentive of moisture is considered the best for growing this crop. In Mr. Cursetjee's gardens, however, the soil was of a reddish colour and of alluvial nature, and the crop of ganja had nevertheless grown vigorously.

Rotation :—Any crop except wheat is a good rotation for ganja. Gram grown as a previous crop, is however, reported to give the best results.

Manure :—Ten to twelve cart loads of farm-yard manure per acre are quite sufficient. The quantity of manure required chiefly depends upon the nature of the soil. In deep black soils no manure is necessary but in light soils it is indispensable.

Preparation of land :—The land is ploughed two or three times just after the previous crop is taken and is then harrowed until a good tilth is secured. The seed is sown between July and August, just at commencement of the season by a seed-drill, the distance between two adjacent rows being about three feet. The seed-rate required per bigha of twenty-three gunthas is equal to two and a half pounds*. The cost of the above amount of seed is from two to three rupees.

When the seed is germinated and the plants are about nine inches high, they are thinned to a distance of about six inches. About twenty days from the the time of germination, selection for the male plants begins. These plants must be found out and uprooted before they have

* Equal to about 4½ pounds per acre.

flowered as they will otherwise lead to the fertilization of female plant which, as mentioned above is not at all desirable. This operation is one of the most important factors in *Ganja* cultivation and therefore requires the most careful, punctual and skillful attention of the cultivator. The first inspection is called 'बाळ पारखणी' (*Bal parakhani*) or the inspection in the young stage. This searching for male plant is done every week or even more frequently and has to be continued till the harvesting time.

It is not an easy matter to distinguish the male from the female plant, especially, in their young stages. It requires a practised and experienced eye. It was explained to us that the peculiar shape and whorling of leaves and the absence of a tapering point on the 'Tik' 'टिक' on the male flower were the distinguishing factors. The name of 'टिक' Tik is given to the unopened flower bud, the one on the female plant having always a long tapering point.

Interculturing:—Interculturing is generally done between the plant by means of a bullock hoe.

Harvesting :—When the crop is ready for harvesting in about five or six months the signs of maturity become visible. The inflorescence turns yellowish and the upper inflorescence becomes large and round.

The harvesting is done at this stage and consists in cutting off the top inflorescence and scraping off by both hands by women of the axillary inflorescences and young leaves. These are then immediately taken to the thrashing yard and spread there evenly. Next day, early in the morning, the whole is trampled by men under their feet for an hour or two, and is then turned over and over. It is trampled again in the cool air of the evening.

This operation is done about three or four times in the morning and in the evening the process being repeated for serveral days, the number of times being determined by the weather.

If the days are hot this trampling is done more quickly and in a shorter time than otherwise as the object of trampling is to prevent the *Ganja* becoming dry and powdery.

When it is sufficiently trampled over, it becomes sticky and then is tied into bundles either as it is or after being sorted.

This sorting is done generally by contract, 12 annas being given for each bundle of about half a *palla**. The sorting consists in separating the large and coarse leaves and stricks from the inflorescences and small tender leaves. In this process nearly half the total produce is reduced. When the ganja is properly packed it is sent to the ware-houses and thence it is sold to contractors. Government collects duty on every palla of ganja.

Produce:—The average produce per *bigha* is about one palla of 240 lbs.† of well sorted leaves and inflorescences. The price of the unsorted *Ganja* which the cultivator gets is from thirty to sixty rupees per palla and if sold at retail prices it is one to two rupees per seer.

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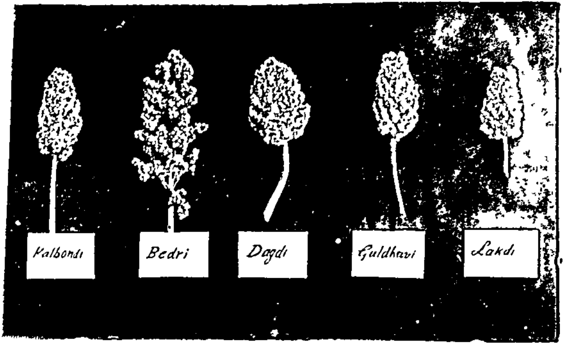
* A *palla* is 240 lbs. †About 400 lbs. per acre.



Varieties of Jowar in Ahmednagar District.

Some of the Commonly Grown Rabi Jowars.

BY

V. K. Kogekar, L. Ag.

THE varieties of Rabi Jowar most commonly grown in Ahmednagar District are—(1) *Kalbondi* (2) *Bedri* or *Lalbondi* (3) *Dagadi* (4) *Guldhani* and (5) *Laldi*.

Each of the above varieties has certain merits peculiar to itself which largely affect its distribution so that it will be of interest to note these special characteristics.

(1) *Kalbondi* :—This variety, as its name indicates, has black glumes surrounding the grains. The head is quite compact and conical in shape. The grain is quite white and has the appearance of pearls. The bread made from the grain of this variety is superior to that from the other varieties. The fodder, too, is very valuable for cattle as it is very palatable and nutritious. It is said that the grain of this variety is more attacked by weevils which makes it difficult or impossible to store. Owing to this defect it does not fetch as high a price in the market as on account of its other good qualities, would be expected. It ripens in 4 months, and is a good yielder. The fodder has always a good market as it is eaten by the cattle without wastage.

(2) *Bedri* :—Also called *Lalbondi*, on account of the grain being surrounded with red glumes. This variety is prominently marked out from all the others by its loose ear-heads. The cultivation of this variety has come into prominence (as it is said) during the last 12 years. It is an early variety and can be grown with limited rainfall. It yields rather poorly when compared to such other varieties as *Kalbondi* and *Dagadi*. It matures in 3½ months. The ear being a loose panicle birds do not get a firm foot-hold on it so it is thereby protected from their attacks to a certain extent. The fodder of this variety is very coarse and cattle do not like it. It becomes still coarser if this variety is grown under irrigation, and is then only used for feeding she-buffaloes. The grain can be stored for a long time if proper care is taken in storage.

(3) *Dagadi* :—As its name indicates, the ear-head is very compact and hard like a stone. It is conical in shape and large. The

grains are set closely packed together in it. With this kind of head there is another advantage and that is that birds find it difficult to get the grain out of it, though they get a firm foot-hold over it. The grain is dirty white in appearance and smaller in size than that of *Kalbondi*. The kernels are surrounded with white glumes. This variety is heavy yielder and is very generally grown for this reason. The grain is of fair quality and keeps well. The fodder when compared to that of *Kalbondi* is a little inferior. However there is little wastage in feeding. This is therefore a good variety for general cultivation as it can be grown without any special conditions of rain-fall. *Dagadi* ripens in 4 months.

(4) *Guldhani* :—In appearance this resembles *Dagadi* except that the head is not quite so hard and compact as the latter. It yields well only in years of good rain-fall. The *Karbee* is poorer in quality than that of *Dagadi*. The grain is similar to that of *Dagadi*. But it is a little bigger in size. This variety is sometimes found mixed with *Dagadi*.

(5) *Laldi* :—The head of this variety is hard and compact like that of *Dagadi*, conical in shape with the top portion of the cone cut off. The ear-stalk is bent downwards like a hook. The head is smaller than that of *Dagadi*. It is a light soil crop and is general grown on shallow light soil portions near a hill-side. The *Karbee* is very tough and without many side leaves and is not eaten well by the cattle who waste quite a portion of it. As a yielder it is inferior to the others and requires 4 months for maturity.

Groundnut for the dry Tract of the Deccan, especially Ahmednagar.

BY

V. K. Kogekar, L. Ag.

THE indigenous variety of groundnut is never grown in the District of Ahmednagar except as an irrigated crop, and in taking up the recently introduced varieties from Japan and America the cultivators have followed similar methods to those with which they were previously acquainted. This note is to call attention to the possibilities of the cultivation of groundnut as a rain crop without any irrigation in this district. If this method is possible then the area that can be devoted to groundnut can be considerably extended.

The Art of Study.

BY

W. Burns, B. Sc.,
Professor of Botany.

THE term *student* means, obviously, one who studies. Though all those who are taking courses at a college are usually designated students, there are, I fear a considerable number of them who hardly deserve the name in almost every educational institution. It is an unpleasant fact that many students, for instance, concentrate their reading into the six weeks before the examinations. Again, I think there are few who really know to take notes of a lecture, and still fewer who know to utilise the library. I trust that the following hints may prove useful to such men.

For the purposes of our argument we may divide the means of study into lectures, practical work, and reading. Practical work includes laboratory and field work, and reading includes the perusal of one's own notes and the use of the library.

As long as lectures remain a part of our course the student must be an expert in note taking. Now the essence of note taking is the expression in precise and abbreviated form of what the lecture has explained at considerable length. No attempt should be made to take down the lecturer's words in full, nor is it necessary or desirable to construct complete and grammatical sentences. I quote a passage from notes actually taken by a Scottish student from a lecture on the Phanerogams:

" Seedcase o embryo : food mat stored as albumen or abs in embryo. This latter more adv. Poss o sep fm food materials. Pot Energy fr early stages o dev when environ suitable. This placing o seed in good place often work o seed or other parts o Sporophyte. Seedaim o fl plant." This passage if expressed in full and without abbreviations would read thus :

" The seed is a case containing an embryo. Food material is stored in the seed either as albumen or absorbed in the body of the embryo. The latter arrangement is the more advantageous, since there is then no

possibility of the accidental separation of the embryo from its food. This food material is a store house of potential energy which the embryo draws upon in its early stages of development when the environment is such as to stimulate germination. The placing of the seed in a good position is often carried out by special mechanisms of the seed or other parts of the Sporophyte. The aim of the flowering plant is to produce seed."

Note taking almost necessarily means the use of contractions and abbreviations which each student must invent for himself. *The* point, however, *is to listen to* the lecturer with concentrated attention and then jot down in a few words the gist of his remarks. Drawings from the lecturer's black—board sketches should be done roughly, aiming only at accuracy in the main points. When the lecturer is drawing a figure on the black—board the student should try to draw it just as fast as the lecturer; he should *not* wait for the completed black—board sketch before starting his.

It is absolutely essential that all lectures should be carefully read over at home on the *same day* as they were taken down. If this is done the notes can be added to and amplified, drawing on the mental impressions of the lecturer's words and sketches. If the perusal of the lectures is postponed, they are strange and difficult to understand when a student comes back to them. After reading a lecture through it is well to jot down the main points and frame written questions for one's self on these points. Take the passage cited above. *Questions* would be—(1) What is a seed? (2) How is food material stored in a seed? and so on. If this question-book is preserved it is a most useful means of readily brushing up one's knowledge of a subject. The information obtained in a lecture must now be amplified by reading. First] take the prescribed text-books, if any, then books from the library, and look up the subject both in chapter headings and in the index and consult every reference to it. It is an excellent plan to put abstracts and precis of these passages in the lecture note-book, alongside the lecturer's treatment of the same theme. The name of the book and its author, and the number of the page ought always to be attached to each abstract. Many books in the library are much too advanced for general reading, but they often give valuable facts on special points. No one should be deterred by the size or abstruseness of a book from [consulting on any subject that concerns

him. After all this, it will still often be the case that some things are not clear to the mind of the student. He should then put his difficulties into the form of short written questions which he can present to his professors for solution.

The results of practical work in the laboratory and field are recorded in note-books. The value of a laboratory note-book consists in its being an accurate record in word and diagram of things actually seen by the student, and it should always be made up in the laboratory and never touched at home. The laboratory and field note-books must be studied in connection with the subjects treated of in lectures and any discrepancies noted and their solution sought out.

Thus a body of knowledge in several subjects is obtained. Now knowledge of one subject must be connected up with knowledge of another subject, and the connections between the various parts of one subject should be made fast in the mind. Thus take again the subject of the Seed. What ought that word to call up in the brain of a student of this college? First, the abstract idea of a seed-what it is and how it does its work; next visions of seeds he has seen and examined their forms and adaptations; then the conditions suitable for the development of seeds or prejudicial to them; thence he naturally goes into the bio-chemical side of the subject and considers questions of food, vitality, stimulus and so on. One might continue such an example indefinitely, taking in every fact in the Universe.

It is also well to put one's facts in order. To have facts in well defined groups in the mind conduces to clear thinking and accurate reasoning. The great advantage of such an arrangement is that one can put small groups into more comprehensive groups, and so on, until finally one can often get some simple expression-some formula-which will at once bring to mind a whole huge collection of facts which it would have been difficult to remember or understand separately.

Finally, it must never be forgotten that the best methods will be of no use if slackly applied. Hard work is still the only road to success.

The Problems of an Irrigation Farmer.

BY

G. L. Kottur, B. Ag.

WATER is one of the most fundamental substances to the life of plants. The functions which it performs in their life history are many. Apart from serving as food it takes an active part in producing turgescence, in causing transpiration, circulation of the sap, and transport of food, all of which are vitally important in every stage of plant growth. For these reasons the successful growing of crops largely depends on the supply of water within the reach of plants which is either maintained by rainfall or secured by irrigation. The advantages of irrigation are little known in countries where the rain-fall is heavy and well distributed, but in places where the fall of rain is both scanty and unevenly distributed the highest success in agriculture in a large measure rests on irrigation.

Water thus is indispensable to the life of plants and is used more than any other substance. But it must be borne in mind that it is not a plant food in itself. It does but little good in the absence of other plant foods in the soil, and sometimes it does more harm than good by its presence in excess, as it then causes waterlogging or brings to the surface a large quantity of injurious salts. Thus the problems of an irrigation farmer are not so simple as they appear to be at first sight. The use of irrigation water is often attended with many evils which can only be prevented by skilful management. The management of an irrigation farm therefore is not an easy task. It consists in securing an adequate supply of good water, in devising the proper methods of conducting the water in the fields, in regulating the supply according to the requirements of the crops, and lastly in laying out certain protective measures wherever necessary. All these things are part of the every day work of an irrigation farmer.

Water for Irrigation:—The irrigation water is generally taken either from wells or from reservoirs. The water of running streams and rivers is also used in irrigation but often it is collected into shallow tanks before it is applied for irrigation. In practically all cases the

irrigation water contains some quantity of the salts of sodium, potassium, magnesium, and calcium dissolved in it. The amount of these salts is often very small but there are many cases in which water proposed for irrigation may actually be objectionable for purposes of irrigation on account of its containing a large amount of these salts. Such water is injurious to vegetation, but even if this degree of concentration is not reached, there will always be the danger that its continued application will make the land, after sometime, unfit for growing any crop whatever. It is therefore advisable to test the irrigation water as often as required in order not to run the risk of killing the crop or spoiling the land. Certain salts are, in small quantity, beneficial in so far as they supply plant food but their presence in excess is exceedingly injurious.

The irrigation waters derived from certain sources contain a lot of fine particles in suspension. These particles settle every time the land is watered and thus leave a fine layer of silt which accumulates in course of them and forms a very valuable addition.

Methods of Irrigation.—The economical use of water, which is the most important matter in irrigation farming depends largely on the manner in which the water is conducted in the fields. Sprinkling of the land with water, which is most unsatisfactory both in point of economy and effect is practised only on a small scale in the watering of pleasure gardens. Irrigation by means of furrows is very common in all places where the water is drawn from wells. Economy of water is one of the chief benefits that is derived from this method of irrigation. It is therefore always desirable to adopt this system especially in canal tracts where owing to the easy availability of a large supply of water the cultivators are generally in the habit of applying far more water than is actually required for the proper development of their crops.

But in the case of crops which require only a few applications of water during the whole period of their growth, flooding is commonly practised in order to save the cost and trouble of making and maintaining the furrows. This also facilitates the operations of hoeing which have to be done very often in the case of such crops. In many parts of the canal areas on the Deccan water is handled badly and uneconomically,—the system of flooding being almost universally adopted. To get the best results, using a system of flooding, it is always necessary to exercise great care in flooding the fields. Water should be made to run

as slowly as possible in between the rows of crops along the depression made by the interculturing instruments. This method will be found more effective than that which is more usually adopted, and should be practised in all cases where furrow irrigation cannot be employed on account of its being more expensive.

The making and maintaining of water channels is one of the important operations of an irrigation farmer. In the majority of cases the main channel should be laid at an angle to the slope and the secondary channels should be made to run more or less along the slope in order to let the water into the beds without much injury to the ridges. A maximum amount of wetting is secured by running the secondary channels exactly along the contour line of the slope. Much difficulty is often experienced on account of the change of levels in conducting water to various places in the field. The trouble in this direction can be minimised by laying out the main water channel along a raised strip and by keeping it as wide as possible. The sides of the water channel should be well rammed to prevent falling in and a series of partial bunds should be constructed by placing stones at the bottom of the course wherever the land slopes considerably to prevent scouring and to raise the channel by collecting the silt. This kind of water channel is simple to construct and when properly laid out should serve most of purposes.

The water channels have a tendency to become soon over grown with weeds. This often gives much trouble by blocking the current of the channels. The roots of weeds growing along the inner surface of the bunds spread out and perforate the walls thus allowing profuse percolation to take place. The scrub growth on this account should be kept continually cleaned and under control. Digging or ploughing in any of the water channels should be as far as possible avoided as it betters the prospect of coming weeds by loosening the soil. Ramming the sides so as to exclude the air if done occasionally will often prevent the water channels running foul.

Choice of Crops:—Apart from climatic conditions of the place, the selection of the most profitable crops depends upon the supply of water, source of manure, local demand for the produce, and the existing facilities for transport. The problem of labour also plays an important part in certain irrigation areas where the climate is unfavourable owing to the prevalence of malaria.

Sugar cane is the king of crops in all the irrigation tracts in this part of India for more reasons than one. It is one of the most paying crops in the country. There is, everywhere, a constant demand for its produce which again keeps well for a long time and can be conveniently transported from one place to another. Other garden crops such as potato, ginger, turmeric, suran, groundnut, chillies &c. are generally taken in rotation with cane. Thus a system of two course rotation with sugar cane as one of the crops is not uncommon in all the localities where facilities for irrigation exist. This procedure entails a heavy loss by quickly exhausting the manurial resources especially nitrogen in the soil and by hastening the rise of underground waters and the consequent development of salt on the surface of the land. The importance of organic matter in the soil of dry regions is not usually appreciated, but it is vital when irrigation is applied, and the lavish application of water to land containing a deficiency of organic matter is the direct cause of many irrigation troubles. For both these reasons it is not desirable to crop the land under heavy irrigation year after year. Under the present conditions prevailing in the Gokak canal tract, for instance, a four year rotation like the following will seem to be very suitable.

1st year.
Sugar cane.
2nd year.
Maize and gram.
(*Kharif*) (*rabi*)
3rd year.
Chillies or groundnuts.
4th year.
San for green manure.

There are in this four course rotation two leguminous crops which serve to fix the nitrogen in the soil. Maize thrives luxuriantly on the residual manure given to cane and gram after maize gives excellent results. San is well known to be an excellent preparation for the succeeding crops of sugar cane. Chillies are one of the favourite crops in the canal area of Gokak. This crop yields well when grown after gram with a dressing of wood ashes. In the fourth year the land benefits by withholding irrigation and by returning the *san* crop to the soil. Groundnut if grown in place of chillies will tend to bring the land into an even better tilth.

In the irrigation districts in the Southern Maratha Country, and particularly in the Gokak canal area, the so-called *karl* land is very common. This land possibly owing to its heavy nature, refuses to grow any of the above mentioned crops. *Khapli* wheat and Broach cotton seem to thrive on such soils better than other crops, and the rotation, therefore, for these soils would be.

1st year.
Broach cotton.

2nd year.
San (green manure) and *khapli* wheat.
(*kharif*) (*rabi*)

Rational use of water:—The tendency of the farmers to be extravagant with irrigation water is marked wherever there is canal irrigation. In view of the fact it is not uncommon to see the crops in irrigated tracts suffering from excess of water rather than for want of it. Under these circumstances the land becomes impoverished and the underground water and salts rise to the surface so as to seriously interfere with the growth of plants. The question of opening a canal therefore is a very serious one as it may actually tend to aggravate the position ultimately, even in famine-stricken districts.

The amount of water which should be applied at a single irrigation and the frequency with which it should be repeated depend on the kind of crop, character of the soil and the rise at which the moisture in the soil is lost by evaporation through the crop and through the soil. All these things are so complicated and difficult to understand that it is not practicable to direct the irrigation farmer on the lines of these controlling factors. Much, however, can be done in this respect by studying the requirements of a particular crop or crops in a certain locality and establishing truths for the acceptance of the ordinary cultivators residing in that tract.

It has been observed in the case of many cultivated crops that the drooping of the leaves takes place when the water content in the soil runs low and is not able to support the evaporation above. This condition is recognised by the most practical cultivators as indicating the best time for irrigating the crop. The growers of chillies of Gokak

keep the soil in good condition so as to absorb the water given in subsequent irrigation which otherwise would tend to run off and be of little avail to the crop.

Irrigation and heavy seeding generally go hand in hand in every part of the country. This practice seems to arise from the desire of the farmers to take as much as they can out of their lands. Proper spacing between the rows as well as between the plants if kept on well manured fields not only increases the yield but also improves the quality of the produce to a remarkable extent. It also facilitates interculturing which apart from controlling the evaporation of soil moisture checks the weeds that cause much trouble by rapidly increasing in number and vigour in irrigation fields.

Irrigation farming on the whole is not easy and introduces many questions which are not considered by a dry land farmer. If used without care and thought, it will and does lead not only to the waste of water, but also to serious and permanent damage to the land. It rewards one who uses it with care but a reckless farmer who takes undue advantage of it never escapes from the ultimate damage and serious loss.

Reclamation of Lands under Tide Water.

BY

Sunderrao Dinanath Navalkar.

LANDS under high tide water, that is to say, low lands, along the seacoasts on the sides of large creeks which become dry at low tide are capable of being reclaimed, either for agricultural puroposes or for preparing salt. Such lands are found on this side of the Bombay Presidency in the Salsette and Bassein Talukas of the Thana District and in Pen and other sea-coast Talukas of the Kolaba, Ratnagiri and Kanara Districts.

The first thing to be considered is, to see whether such lands are capable of being reclaimed at a comparative small expenditure so as to make the reclamation pay financially. The next thing to be considered is, to see whether the land after being reclaimed, can be brought under cultivation. Having considered these points, regular work or reclaiming land may be begun. But before commencing the work, the land should be surveyed and the line of the proposed dam to stop water being spread over the land to be reclaimed, should be marked out on the plan, after taking levels on the land at different places at high tide, in order to enable the work to be done exactly, according to the requirements of the land.

The work of reclamation is carried on by putting a mud dam the height and width of which are to be determined by taking levels of water, at high tide, and the situation of the dam to be determined from the currents of high tide water. If the currents are strong, the dam required to be put will have to be of greater width in order that it may not be washed away or damaged at every high tide. Under normal conditions, a dam eighteen feet wide at the base and six feet wide at the top with a height of six feet will serve the purpose if there is no danger of it being washed away. It is better to have more slope on the outer side of the dam, than that on the inside, as there is greater possibility of the earth on the outer side of the dam being washed away.

The situation of the dam after taking levels on the land at different places at high tide, as stated above, should be fixed in such a way that the greater portion of land to be reclaimed would not be under sea-water at an ordinary high tide. The length of the proposed dam will depend more or less upon the situation and the position of the land to be reclaimed. *Care should be taken to mark out the line of the dam and to* avoid creeks either small or large, that may come across the suggested line of the dam, by giving a turn if possible to avoid them. If this cannot be done there is no other alternative but to fill them up along the line of dam with earth. While commencing the work of contruction of a dam, it is better to mark out the base of a dam to be constructed by coir rope lines in order that the dam will appear regular and neat. Earth for dam construction is taken up from the outer side of the dam at a distance of twenty-five to thirty feet away from the base of the dam by digging pits ten feet square or ten feet by twenty feet and one foot deep. The wet earth is dug, not with pickaxes and shovels but by a wooden

board of digger-like shape called '*Pensa*'. The clod of earth that is dug out with it, is thrown between the marked line of the dam to be constructed and two to three men are engaged to tread upon the clods of wet earth, in order to consolidate the whole mass of earth. In this way clods of earth are put together till the dam is constructed to the required size and height.

If a large creek, say about eighty feet in width which becomes dry at low tide, is required to be closed by a dam, the best way is to fill it up to the level of the ground before high tide begins. The work of laying a dam across such creeks is generally begun between the sixth and twelfth day of the first or second half of the Hindu months, when water at high tide does not generally rise up as high as it rises on the new moon and the full moon day.

In order to put a dam across large and shallow creeks the best way is to put first on either side of the base line of the proposed dam, dykes of dry stone about four feet in width at the base and *two* feet at the top with a gentle slope on the outward side to half the height of depth of the creek, in order that the clods of earth for filling up the creek may not be washed away being thus held together by stone dykes. The next thing to be done, is to construct a Bamboo and *Tiwur* shrub (*Barringtonia acutangula*) fencing on the line of the proposed dam, in such a way, as to leave a passage of about four feet in width for water to pass in and out in case the work of filling up the creek is not completed before the high tide begins.

After making these preliminary arrangments, the work of filling up the creek is begun from both the sides of the creek by about three hundred men, (the number of men to be engaged depending upon the quantity of work to be done), one hundred and fifty men on each side, by throwing into the creek clods of earth that are dug from pits at a distance of 50 feet away from the creek, with the wooden board called '*Pensa*'. Care should be taken to see that earth is not taken from the place nearer the creek to be filled up and the pits that are dug up are not more than two feet deep.

Sometimes gunny bags are filled up with earth and are arranged on either side of the marked line of the dam, one over the other, in piles like a wall in order that the clods of earth thrown into the creek for filling it up may not be washed away and dissolved in case the portion

of work remains uncompleted before the high tide begins. The gunny bags will to a great extent hold the earth and will not allow the earth to be washed away and thus save the expense of possibly having to fill up the creek with earth again.

If a creek is wide, and at the same time deep, that is, it does not become dry at low tide and that water remains in it to the depth of six to ten feet, then in that case, in addition to the dry stone dykes on both the sides of the proposed dam, as already stated above, disabled native crafts, filled up with stones and earth should be put lengthwise in the creek along the line of the dam. In this way a deep creek is bottled up and at the same time the depth of the creek is reduced to a greater extent, and thus there is less possibility of clods of earth that are thrown into the creek, being dissolved into the water of the creek. In this way a dam across a deep creek is constructed.

The next point is to consider about the location of sluices, to allow storm and other water to pass out of the reclaimed land. The number of sluices and their position will depend on the drainage of the land during the rains. Care should be taken to see that the size of sluice is sufficient to carry floodwater quickly out of the reclaimed land otherwise the reclaimed land will become water logged and besides, there is a great danger of having breaches made in the dam on account of the force of the floodwater on the dam from within. In this way there will be great loss to the standing crop and, besides, great expense will have to be incurred to close and fill up a breach in the dam again.

Sluices should be located at one of the places in the dam, through which the natural drainage of the land would pass. At the same time sluices should not be located near a big filled up creek. Having fixed up the location and number of sluices, the next point for consideration is, to see what kind of sluices would serve the best purpose at a very small cost. According to my experience the sluices that we have constructed at our "Dinanath Khar" are of the best and cheapest of the kind in the long run. They are constructed of ordinary flap doors four feet by three feet six inches in size suspended on iron bars passing through female hinges fixed to the doors; which automatically open out-ward during floods, thus allowing floodwater to pass out, and shut at high tides, preventing sea-water from entering, and spreading over the reclaimed land. Such doors save the wages of a man to watch the sluices during the rains to see that the passage for the floodwater to go out is not closed, as in the case of screw sluices.

There is a great disadvantage in constructing screw sluices, because if a watch-man absents himself at a time of flood or neglects to raise up the screw sluice board, then there is the danger of having breaches in the dam. In the case of a flap-door sluice there is little danger of *having breaches in a dam for the flap-doors do their work automatically* of opening for floodwater to pass out and of shutting against high tide water to enter in. Care should be taken to construct a sluice with deep foundation filled up with concrete if the soil on which it is to be con_ structed is not a hard rocky soil, otherwise there is a great danger of the sluice work, being washed away during the rainy season by the force of the storm water. The only yearly expense for a flap-door sluice is that of applying coal-tar to the wooden flap-doors, and the cost of in- *comes about a rupee or two according to the number of doors. I have* attached a plan of flap-door sluice, constructed at our "Dinanath Khar".

After completing the chief works of building the dam and constructing sluices, the next thing is, to construct from within ten to fifteen feet away from the dam, a minor dam, with a width of three feet at the base, one and a half feet at the top, with a height of two feet, parallel to the dam, which may well be called the main dam, in order to catch sea-water that may percolate inside through the main dam at high tides. The necessity of this dam is that it does not allow sea water that percolates through the main dam to spread over the reclaimed land and to become saline; and thus makes the land fit for cultivation.

The next thing to be done is to root out any sea-water shrubs called '*Tiwar*' (*Barringtonia acutangula*), plot out fields in squares or rectangles, and lay field dams, according to the nature of crops that are required to be grown. Two or three years are required in Western India before any crop can grow on the newly reclaimed land, for the reason, that the soil was saturated with minute particles of salt formed from the sea-water that dried after the land was reclaimed. Unles these particles are washed away by rainwater for two or three year continuously the reclaimed land cannot be brought under cultivation.

If there are a number of creeks on the reclaimed land the best wa of seeing them filled up to the level of the ground, is to have cross dams in the creeks at an interval of one hundred feet. By this process which is known as '*Warping*', the creeks will be naturally filled up in course

of time by the silt of floodwater during the rains. In this way low lands also raised up to a certain extent. And so the reclaimed land can be brought more or less to one level. The principle at the bottom is that during rains these cross dams hold the muddy water and the other impurities of the surrounded land suspended in floodwater while flowing from one partitioned portion to another, and thus slit and slime are deposited in these portions until they are on the same level with the surrounding land. Thus during the course of few years, the low land will be raised up to the level of the surrounding land. The truth of this principle is clearly observed from the pits that are dug on the outer side of the dam for taking earth for constructing a dam. These get filled up during the course of few months, because the slime of sea-water is deposited in them twice during the course of twenty-four hours at low tide. This occurs because the slime is rapidly coagulated in sea-water and is, hence, more quickly deposited than the slime in fresh water. By the method described, the water logged lands can be brought under cultivation. It takes, however a long time to make low lands in level with the surrounding land.

The crop that is grown on newly reclaimed land is that of inferior kind of rice, known as '*Bhat*' or '*Khare Bhat*' the husk of which gives of a saltish taste and the rice of which is of reddish colour. For the growth a crop in reclaimed lands, the land need not be ploughed for year together, even when a better kind of coarse rice crop, generally known as '*Sweet Bhat*', is grown on it. After a few years the land becomes fit for the production of the better kind of sweet coarse rice. The rice seed is spread broadcast on the land, just before the commencement of the monsoon, or germinated seed is thrown on the ground just after two or three good showers of rain. The object of the first method of sowing seed is to be secured against scanty rain at the commencement of the monsoon. Very few cultivators adopt the first method of sowing in the coast lands of Western India, and the second is usually adopted by almost all cultivators. After the seed is sown there remains nothing to be done except to remove weeds from the field and see that water from the fields does not escape away through breaches in the field dams. Some use ploughs and harrows in newly reclaimed lands to remove weeds just after two or three showers when the soil becomes soft. This instead of saving labour tends, however, to injure the crop by stirring up the sub-soil, which is more saline than the top soil So

repairing the dam instead of taking it from the outer side as is usually done. The earth from reclaimed land has more or less become 'sweetened' and when we put the same on the top of the dam, grass grows on it luxuriantly and so the top of the dam is protected from rain.

The texture of the reclaimed land is much improved after growing salt rice crops for some years and better crops can be grown on such lands *Cocoanut trees and mango grafts thrive* well if there is sufficient quantity of sweet water available close by. If no sweet water wells can be dug close to the reclaimed land there is no alternative but to depend upon the rain water and no crops can be grown at any time of the year except during the rains. In this way the land will remain idle for the greater part of the year. So if 'sweet' lands *i. e. Kharif* lands adjoin a reclaimed area, one should go in for purchasing a few acres, for digging wells in order to plant cocoanut trees or other good crops. In this way reclamation of lands for agricultural purposes will be more profitable.

It will be seen from the above facts that reclaimed lands which are known as *Khars* do not require the services of cattle for agricultural purposes to any great extent, nor do they need agricultural implements except crow bars and the *khudal* if only rice crops are to be produced. The cultivators from the Pen Taluka in Kolaba District are experts in growing good rice crops from *Khars*, when compared with the other cultivators in different places. These men know very well how to bring *Khars* under cultivation, and besides they are extremely industrious. From my experience I have found out that they are the best sort of cultivators for growing rice crops on reclaimed land, and the yield of their produce is always greater than that of other local cultivators.

Now I shall turn to the practical side of the question of our "Dinanath" *Khars* viz., the terms and conditions with the Government and our tenants and how far the reclamation has proved successful.

The land has been leased out to us on a lease of 999 years by the Government, after paying about Rs. 10,000 as the price that was fixed according to the highest bid in an auction, held by the Government on the spot in the year 1888.

The principal terms and conditions of the lease are that we are to be exempted from paying any revenue to the Government for the period of first ten years and that for the next twenty years the revenue is to be

paid to the Government at the rate of four annas per acre plus the Local Fund cess. After the completion of twenty years *i. e.* after thirty years from the date of the purchase of the land it is to be resurveyed and re-assessed according to the terms and conditions prevailing then for land in the surrounding localities. After the expiration of the period of the lease it is to be renewed.

As regards the terms and conditions with the tenants they are the same as those prevailing almost everywhere on our side. They ented into a yearly agreement with us and bind themselves to keep the dam of their fields in repair, to sow seed, to look after weeding &c., to reap *the crop, to tie it into sheaves, to stack them at a threshing place, to* thresh the sheaves and collect the grain and do all other necessary things at their own expense and to give us half the quantity of corn and straw They from harvest time do every thing under our supervision and control and the land they cultivate remains no more in their possession as soon as the crop is gathered, unless they renew their agreement for the next year.

The total cost of reclamation has come to about Rs. 27,138 which includes the sum of Rs. 8,365 as interest at 6% on the capital spent, till the end of September 1896. The reclamation work was completed after a long delay of five years from the time of its commencement on account of the sudden transfer of my father the late Mr. Dinanath Harischandra, first grade P. W. D. accountant, to the then newly created post of travelling auditor. Although the reclamation work was completed in the year 1896, some portion of the land became fit to be cultivated from the year 1894, and one *mooda* and fifteen *fares* anh eleven *payalis* of *Rate Bhat* was received by us as the half share of the produce from about nine acres of land in that year. In the year 1895 *the produce was doubled and the area of land cultivated was also doubl*ed. In the year 1896 *i. e.* in the year of the completion of the reclamation work the land brought under cultivation was about thirty acres and the produce of that year of our half was only one *mooda* and sixteen *payalis* owing to the great drought in that year.

Now we shall see how far the reclamation proved to be successful financially after making the above preliminary remarks as to its produce when just completed. In the year 1897 we were able to recover net $2\frac{1}{2}\%$ interest on the sum of Rs. 27,138 and the land brought under *cultivation was about forty acres : and the average yield per acre was* five *fares.*

In the year 1898 about eighty acres of land was cultivated and the average yield per acre was ten *fares*. This year we were able to produce sweet course rice for the first time, and the net interest that we were able to realise was 3 %.

The average interest that we were able to realise on the capital during ten years *i. e.* from the time of the completion of the reclamation work to the year 1905 was at 3% and the land that was brought under cultivation was about one hundred and forty acres, and the average yield per acre was ten *fares* and during the last five years that is from the year 1906 to 1910 the average interest that we realised was 3½%, the land under cultivation is at present about two hundred acres and the average yield per acre of the land actually under cultivation is about eighteen *fares*.

It may be difficult to understand, how, out of 600 acres of land, only 200 acres have been brought under cultivation. The reason is that some portion of the land is not fit for cultivation on account of its low level which will be raised in due course of time by the method of warping as already explained above. Beyond this it may be said that although most of the land is fit to be cultivated, on account of want of cultivators it has remained uncultivated and hence we realise only a small rate of interest. But as time passes the land is improving day by day and so the amount of interest that will be realised on the capital will tend to increase. In the end the *Khar* will, we believe, be a profitable concern if we are able to procure labour to cultivate the land, otherwise not.

During the monsoon of 1911 I did an experiment with regard to the growing of fine sweet rice on an acre of reclaimed land, in order to show to the cultivators that reclaimed land which is generally termed a '*Khar*' can be made to produce a fine quality of sweet rice with the same amount of labour as is required for producing course sweet rice, and I am glad to state that the experiment proved to be successful and it convinced the cultivators that fine sweet rice can be produced from '*Khars*'.

Seed Testing

BY

G. D. Mehta, L. Ag. B. A (Camb.).

MOST of the material given in this article has been published in detail in the form of bulletins of the Agricultural Department Bombay,* but it seems worth while that some of the results described there might be summarised and repeated here in the form of an article for the information of those who have not got enough time to refer to the various bulletins and go into the details of the subject.

Nature of seeds.—A seed consists of a young plant or embryo with a supply of food either in the embryo or surrounding it, all enclosed in the seed coats. The food is formed by the parent plant and is stored up in the seed to give the young plant a start in life. Some seeds have a small amount of stored food, while others have enough to keep the young plant growing several weeks without having to obtain much food from other sources. As the seedling develops it gradually makes more and more of its own food until finally the stored food is no longer needed.

The necessity of testing seed arises from the fact that not every sample of seed consists of pure seeds as it professes to do, nor does every pure seed contain a living germ the absence of which makes the seed useless for the reproduction of its kind.

Good seed is essential to successful agriculture, no matter how well the farmer prepares his land, no matter how much time, labour and money he spends on it, if much or all his seed fails to 'come up' he will either have a poor crop or will be obliged to resow, thus losing time and labour.

The expense of preparing the land is the same whether good or bad seed is used, and the cultivation and management of the crop, whether large or small is nearly the same; it is therefore important that the seed obtainable should be sown as the difference in primary cost between this and seed which is doubtful is, small compared with the difference between the final results obtained from using them.

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*Bulletins of the Department of Agriculture, Bombay No 10. 37, 43 &c

"The best seed obtainable is never too good" is a maxim which should always be uppermost in the mind, when sowing is under consideration. Cheap seed is not necessarily bad, but it practically always is so. The cheapest seed is usually the most expensive in the end. Bad seed leads to disappointment in many ways, besides the defecient crop which often results from its use. It is frequently the indirect cause of trouble in introducing weeds, which smother the crop and leave the land in a foul condition; seeds of parasitic plants, as for instance, lucerne dodder, and spores of fungus diseases, as for instance, jowar smut are also present, and these are accountable for many of the diseases of farm crops.

There is every reason to believe that one cause of the partial failure of crops is due to the use of inferior seeds. For instance, cotton seed ordinarily used in the Broach and the Ahmednagar districts for sowing purposes contains on the average less than sixty per cent of useful seed, that is to say seed which will grow into a plant when planted under favourable conditions.

Farmers and gardeners get seed from one of two sources, they either grow it themselves or buy it. If the former, there is less danger of its being poor. The chief source of poor seed is careless handling in harvesting, threshing and storing. Only well-to-do farmers are able to store their own seed. The poorer cultivators are obliged to use up all the grain that they raise from their farms either for home consumption or to pay the dues of Government and the *Sawkar*. They are therefore unable to carry an adequate stock of seed from harvest until the following seed-time, and have to buy their seed from a relation or a neighbour at a very heavy rate. Failing this they have no other recourse but to approach the village *bania*, or their *Sawkar* for their seed and accept whatever the *bania* has got to offer and pay over it interest of twenty-five per cent or more. It can easily be understood how this may lead to the sowing of poor seed and also to deterioration in the type of seed sown.

The value of any particular sample of seed, leaving aside for the moment the question of whether the seed be of the correct variety or no, depends on three factors. These are in the first place, the purity of the sample, or in other words its freedom from dirt, or the seeds of weeds in the second place the proportion of seeds which will germinate;

and in the third, the speed or energy of germination. In some cases of course, a rough estimate of the quality of the seed may be obtained by an examination of its shape, colour and smell; but this is not sufficient Seed may be made to appear what it is not in reality. A little oil mixed with a sample, will make old seed appear as new, and it is only after a determination of the above factors that a sound judgment of the quality of a sample of seed can be formed.

Purity:—The impurities generally present in a sample of seed are of two kinds, namely :—

(1) Mechanical, or Inorganic and dead matter { *e. g.* broken seed, stalks, particles of clay, sand, dirt, pieces of chaff &c.

(2) Organic or Living matter { *e. g.* weed seed and seeds of other crops.

A small percentage of deleterious seeds often means a considerable number of weeds per acre, hence in examining the samples, it is not merely necessary to determine the total amount of impurity present, but its nature is of importance.

To determine the purity, a sample is weighed and separated into (1) pure seed, (2) weed seeds, (3) inert matter, dirt, broken seeds &c. Each is then weighed and percentage of purity found out.

Germination capacity:—The germination capacity of the pure seed or proportion of seeds which will germinate is next determined the embryo or young plant inside the seed must be alive for the germination to take place. The number of ungerminable seeds in any sample will depend upon (1) the kind of seed, (2) conditions of growth, (3) age of seeds, (4) methods of gathering and storing &c. Imperfect development of the embryo during ripening, mechanical injury in threshing and ginning and too high a temperature and excess of moisture in the storeroom are very often the causes of poor germination capacity.

A home germination test may be made as follows :—Lay a moist blotter or a piece of moist cotton flannel on a plate. Count out one hundred seeds just as they come. Put them on the moist blotter, cover with a piece of paper and then with another moist blotter. Lay over this a piece of glass or cover with an inverted plate. Keep in a mode-

rately warm place and examine from time to time. Remove the sprouted seeds and count them to get the percentage of germination. Several samples may be tested at one time on a plate.

When the germination capacity has been determined, the percentage of useful or living seed in the original sample can be given. This is simply obtained by multiplying the percentage of purity by the percentage of germination in the pure seed. Thus a sample of seed showing 90 percent purity and 80 per cent germination has a real value of 72 percent only, that is every 100 lbs. contains only 72 lbs. really good and useful seed. $\frac{90 \times 80}{100} = 72$ percent.

Energy of germination :—In addition to pure seed possessing a high percentage of germination, the farmer requires seed that will sprout uniformly and vigorously. Often a seed will have vigour enough to start germination but not enough to be able to establish itself in the soil. It is not enough that a seed germinates, but it should germinate vigorously also. Well ripened seeds usually germinate more rapidly than those imperfectly ripened. Immature seeds produce weak plants and when stored lose their germinating power sooner than well grown ones.

Drawing a sample of seed for testing :—The aim in selecting a sample of seed for testing should be to obtain in as small a bulk as possible at least some seeds of every kind and grade in the whole quantity, and in the proportion in which they actually occur. Samples must never be taken by picking out the seeds one by one since this almost invariably results in the selection of too high a percentage of those seeds that are the largest and apparently the best. If the quantity to be tested is considerable, small amounts should be taken from different parts of the mass. In taking a sample from a bag, it must not be taken from the top alone, but also from the middle and from near the bottom. These small samples, from the larger samples out of which the proper amounts of seeds are to be taken, both for testing the purity and germination capacity, are thoroughly mixed.

The proper quantity for a sample of small seed to be tested, as for nstance seeds of tobacco, would be about one to two ounces, and in he case of larger seeds *e. g.* jowar, wheat &c. a quantity not less than our ounces should be taken.

Storage of seed and protection against weevil attack :—We must always remember that seeds are alive. It is true that they are dormant and can stand some adverse conditions but they are not immune from injury. One of the chief causes of the poor germination of cereal seed is heating during the storage. Any seed that smells musty needs to be tested before being accepted for sowing purposes.

The greatest enemies of seed when stored by a farmer are weevils. Bajri and Jowari, if preserved in the ear and in sacks properly filled and covered on all sides with a thick layer of '*bhusa*' or straw, will keep free for a long time. Some of the people have gone further than this; they mix woodashes and sometimes a little mercury with the Bajri grain and then store it in large earthen jars. It is observed at the seed testing laboratory, Poona, that the treatment of Bajri grain with mercury does not materially injure the germination capacity of the seed.

Tur, *Wal* and other pulses are protected against the weevil attack by smearing them with some oil mostly castor or *Til* oil.

In this connection, I might mention our attempt at this laboratory to combat the weevil attack in cereals and pulses by smearing them with heavy petroleum oil. The effect of petroleum oil, when used in quantities, as much as about two ounces and a half per ten pounds of the seed smeared, has been to seriously diminish the germination of both the wheat and jowar seeds, while its effect on the *Tur* seed has been very small.

On the whole it is clear that in the case of pulses, a smearing with about two ounces heavy petroleum oil per ten pounds of the seed smeared, acts as a complete preventive of weevil attack, without any appreciable injury to the seed for at least twelve months, even when badly attacked seed is quite close by. *Tur* and other pulse seeds of similar kind are those which are usually most seriously damaged by weevils. Smaller quantities of the petroleum oil than two ounces per ten pounds of the seed smeared, have not been quite so successful in preventing the weevil attack, after three or four months of storage in contact with the oil. Of course it will immediately be recognised that seed smeared with petroleum oil cannot be used for consumption as even after twelve months it gives off a very objectionable smell.

We may now turn to a brief consideration of the quality of the actual samples of seed in use by the cultivators of the Bombay Presidency. For Gujerat and the Deccan special investigations were undertaken for one district in each of the provinces, while for the Southern Mahratta Country, the Konkan, the Khandesh, a large number of samples of different seeds have been received for examination from the Divisional Inspectors of Agriculture and Superintendents of various farms in those provinces. The results obtained have been recorded in the various bulletins issued by the Bombay Agricultural Department, on the examination of the seed supply of the Broach and the Ahmednagar Districts. A special investigation was also undertaken for an intensive study of the seed supply of a village near Poona. The average results given for the various crops of the Bombay Presidency in the following table, set out in comparison with those of exhibition samples received from Peth (Satara District) are calculated from the total results of all the above mentioned samples of seeds examined.

The average percentage of useful seed obtained for all the samples of cereal seed examined (in all 1133 samples) is 84·5 per cent; while that obtained for the exhibition samples of the same is 92·4 per cent. There is therefore a difference of about eight percent in favour of the exhibition samples. The western standard of germination capacity for similar cereal seeds is 95 percent. Thus our exhibition samples nearly reach it, but in the case of ordinary samples of cereal seeds used for sowing purposes, we have much to improve.

In the case of pulses, the average percentage of useful seed for all the samples examined (716 samples in all) is found to be 84·4 per cent; while that for the exhibition samples of the same seeds is 89·1 per cent. The western standard for similar pulse seeds varies from 95 to 98 percent. Thus in this case also our samples are very much below the mark.

With some pulses the germination is greatly impaired owing to the presence of 'hard' seeds, with others owing to weevil attack. 'Hardness' is generally due to the thick impervious seed coats of the seeds, through which water cannot permeate and reach the embryo plant within the seed to make it grow. When a 'hard' seed is scratched on its surface with a pin, it sprouts in many cases on the very next day.

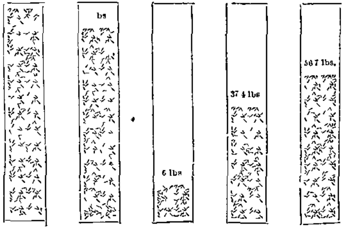
Common Name.	Latin Name.	Source.
Wheat ..	Triticum .	Different parts of the Bombay Presidency
do .	do .	Exhibition Sample ... ...
Jowar .	Sorghum vulgare ..	Different parts of the Bombay Presidency
do	do .	Exhibition samples ... ...
Bajri .	Pennisetum typhoideum	Different parts of the Bombay Presidency
do	do .	Exhibition samples ... ...
Rice ..	Oryza sativa . .	Different parts of the Bombay Presidency
do	do	Exhibition samples .. ...
Inferior Millets	Paspalum Scrobiculatum Sataria italia .	Different parts of the Bombay Presidency
do	Panicum M. .	Exhibition samples ... ...
Tur ..	Cajanus indicus ..	Different parts of the Bombay Presidency
do .	do ...	Exhibition samples ...
Gram ..	Cicer Arietenum ..	Different parts of the Bombay Presidency
do	do ..	Exhibition samples ... ...
Kulthi .	Dolichos biflorus ..	Different parts of the Bombay Presidency
do .	do	Exhibition samples ... ...
Math .	Pharotous aconitifolius	Different parts of the Bombay Presidency
do .	do ..	Exhibition samples .. ...
Mug ..	Phaseolus mungo ...	Different parts of the Bombay Presidency
do ..	do ..	Exhibition samples ... ...
Udid .	Phaseolus radiatus ..	Different parts of the Bombay Presidency
do ..	do ...	Exhibition samples ... ...
Chavli ..	Vigna Catiang ...	Different parts of the Bombay Presidency
do ..	do ...	Exhibition samples .. ...
Val ...	Dolichos lab-lab .	Different parts of the Bombay Presidency
do .	do ..	Exhibition samples ... ...
Gavar ...	Cyamopsis psoralioides	Broach District ... .
Lang ..	Sathyrus Sativus ...	do ... ...
Til ..	Sesamum indicum ...	Different parts of the Bombay Presidency
Safflower seed	Carthamus tinctorius ...	Ahmednagar District ... ...
do ..	do ..	Exhibition samples .. ...
Linseed ..	Linum usi-tatissimum ..	Different parts of the Bombay Presidency
Nigerseed .	Guizotia abyssinica ...	do do do
do ..	do ...	Exhibition samples ... ...
Caster seed ...	Ricinus Communis ...	Different parts of the Bombay Presidency
do ..	do ...	Exhibition samples ... ...
Cotton seed ...	Gossypium ..	Different parts of the Bombay Presidency
Deccan hemp	Hibiscus ca abinus ...	do do do

Number of samples.	Purity %	Germination %	Useful seeds. %	REMARKS.
233	95 6	90 3	86·4	Some of the samples were attacked by weevils.
6	99 8	93 2	9 3	do do do
324	97 3	82 6	80 2	
9	99 9	93 6	93 5	
264	98·2	85	83 4	
4	99 3	93 4	90 7	
122	97 5	90 3	88	
3	99 3	97 5	96 8	
190	97 2	87 3	84 6	
12	97 8	90 3	88 3	
113	95 8	83	79 5	Some of the samples were attacked by weevils.
4	97·9	93·4	91 3	
96	97	95 1	92·3	
6	99·6	99	98 6	
87	95·2	91 7	87·3	
5	96 9	85·6	82 0	About 10% 'hard' Seeds.
123	94 3	91 2	86 3	
6	98·5	95	92 6	
118	96	86·7	83 2	Some of the samples showed about 50% 'hard' seeds.
3	99·9	97 3	97 2	
59	95 5	83 8	80	
2	98 5	94 2	93 1	
48	97·3	86 6	84	Some of the samples showed 20% 'hard' seeds.
4	98 2	89	87 4	do do do 10% do
28	97·4	77 9	76	do do do 20% do
4	98 6	71 1	70 1	do do do 25% do
28	95·1	89 2	85 1	About 15% do
16	92	94·2	90 8	Some of the samples were attacked by weevils.
148	97	88	85 3	
78	94	86·5	81·3	
5	98·7	98·7	97·5	
20	96·7	96·3	93·1	
32	95·7	93 7	89 7	
4	98 2	98 2	96 4	
18	98·9	79 2	78·4	
3	100·	88·5	88·5	
120	94·	60 2	56·7	
30	94·	88 7	83 5	

In the case of oil seeds the average percentage of useful seed obtained for all the samples examined (namely 296 in all) is 85·5 per cent. That for the exhibition samples of the same is 94·1 per cent. Thus the ordinary samples of oil seeds used for sowing purposes are about nine *percent inferior to the exhibition samples.*

The climax of low quality of the seed used for sowing the land is reached, when we come to the cotton seed. The average percentage of useful seed obtained for all the samples of cotton seed examined (namely 120 in all) is 56·7 per cent only; that is to say nearly half the amount of the seed sown is buried in the ground as dead organic matter. This can be made quite clear by means of the following figures.

Fig. No. I represents 100 pounds of cotton seed as bought. No. II shows the quantity of pure, genuine seed in the same. No. III gives the amount of husk, dirt &c., in the original quantity. No. IV shows the quantity of damaged and dead seeds in the original seed. No. V indicates the quantity of pure and germinable seed in the whole amount, that is to say useful seed percent.



No I	No II	No. III	No. IV	No. V
100 lbs. cotton seed as bought	Pure, genuine seed in the same	Impurity, husk, dirt &c.	Damaged and dead seeds.	Pure and germinable seed.

Thus we see how low is the quality of the cotton seed, which is used for sowing purposes by our *farmers.* But *even this is not* all, The proportion of inferior seed is really even greater than would be indicated by these average figures; for included among them are a

considerable number of samples of really high quantity. Hence it is obvious that very inferior samples must also be found in large numbers. This is very clearly shown by the following summary derived from a consideration of all the samples of cereals, pulses, oil-seeds and fibre crops examined.

Out of the 1133 samples of cereal seeds examined.

9	gave between	30 and 40	per cent	of useful seed.	(·8	per cent.)
14	,, ,,	40 and 50	,,	,, ,,	(1·2	,, ,,)
33	,, ,,	50 and 60	,,	,, ,,	(3·0	,, ,,)
100	,, ,,	60 and 70	,,	,, ,,	(8·8	,, ,,)
166	,, ,,	70 and 80	,,	,, ,,	(14·7	,, ,,)
412	,, ,,	80 and 90	,,	,, ,,	(37·3	,, ,,)
399	,, ,,	90 and 100	,,	,, ,,	(35·2	,, ,,)

Thus over twenty-eight per cent of the samples of cereal seeds gave less than eighty per cent of useful seed while the average percent of useful seed is 84·5.

In the case of pulses, out of the 716 samples examined,

4	gave between	20 and 30	per cent	of useful seed	(·6	per cent.)
5	,, ,,	30 and 40	,,	,, ,,	(·7	,, ,,)
14	,, ,,	40 and 50	,,	,, ,,	(2·0	,, ,,)
26	,, ,,	50 and 60	,,	,, ,,	(3·6	,, ,,)
46	,, ,,	60 and 70	,,	,, ,,	(6·4	,, ,,)
92	,, ,,	70 and 80	,,	,, ,,	(12·8	,, ,,)
247	,, ,,	80 and 90	,,	,, ,,	(34·5	,, ,,)
282	,, ,,	90 and 100	,,	,, ,,	(39·4	,, ,,)

Over twenty-six per cent of the total samples examined contained less than eighty per cent of useful seed. The average percentage of useful seed is 84·4.

For the oil-seeds, out of the 296 samples examined,

1	gave between	20 and 30	per cent	of useful seed	(0·3	per cent.)
1	,, ,,	30 and 40	,,	,, ,,	(0·3	,, ,,)
10	,, ,,	40 and 50	,,	,, ,,	(3·3	,, ,,)
7	,, ,,	50 and 60	,,	,, ,,	(2·4	,, ,,)
13	,, ,,	60 and 70	,,	,, ,,	(4·4	,, ,,)
40	,, ,,	70 and 80	,,	,, ,,	(13·5	,, ,,
106	,, ,,	80 and 90	,,	,, ,,	(36·0	,, ,,)
118	,, ,,	90 and 100	,,	,, ,,	(39·8	,, ,,)

Over twenty-four percent of the total samples of oil seed crops examined are below the eighty percent standard of useful seed; while the average percentage of useful seed obtained is 85·6.

In the case of cotton seed the figures obtained are most interesting. Out of the 120 samples examined,

4 gave	between	20 and 30	percent	of useful	seed	(3·3 per cent.)
45	,,	30 and 40	,,	,,	,,	(37·5 ,, ,,)
18	,,	40 and 50	,,	,,	,,	(15·0 ,, ,,)
19	,,	50 and 60	,,	,,	,,	(16 0 ,, ,,)
17	,,	60 and 70	,,	,,	,,	(14·0 ,, ,,)
15	,,	70 and 80	,,	,,	,,	(12·5 ,, ,,)
2	,,	80 and 90	,,	,,	,,	(1·7 ,, ,,)

Thus over ninety-eight percent of the total samples examined, showed less than eighty percent of useful seed, and over sixty percent of the samples contained less amount of useful seed than the average percentage obtained for the total number of samples, namely 56·7 p. c.

One can now see easily how the average percentage of useful seed is not sufficient by itself to give a true conception of the quality of the seed examined.

The chief reason of this very low percentage of useful seed in the case of cotton may probably be traced to the system of buying seed from a local ginning factory where all sorts of seed cotton are mixed before ginning, and a great amount of seed is damaged by steam ginning. A very heavy seed rate has always been found necessary in India in consequence, to secure the requisite stand in the field.

The samples of seeds examined were on the whole fairly free from impurities, but many of them, specially those collected from the Deccan, showed the presence of weeds seeds. The weeds seeds most often noticed were of the following plants :—

(1) *Alysicarpus ragosus* vern. '*Sherra*'
(2) *Ipomæa sp.* vern. '*Bhowri*'
(3) *Indigofera glandulosa* vern. *Barbada*
(4) *Commelina forskaleii* vern. '*Kena*'
(5) *Celosia argentia.* vern. '*Kurdu*'
(6) *Amarantus sp.* vern. '*Math*'
(7) *Argemone meticana* vern. '*Pivala Dhotra*'
(8) *Rhinchosia minima* vern. '*Padval*'
(9) *Heylandia latibrosa* vern. '*Godhadi*'
(10) *Panicum isachne.* vern. '*Sipi*'
(11) *Eragrostis plumosa* vern. '*Chiman chara*'
(12) *Crotolaria oritensis* vern. '*And Bail*'

Conclusion:—Finally it may be worth while to summarise the conclusions which have been drawn during the course of this article.

(1) There is no lack of appreciation on the part of the farmers of the benefits to be derived from choosing seed from the best of the produce and the practice is followed as far as possible with many of the crops.

(2) The seed as sown, though fairly free from impurities, is not satisfactory from the point of view of germination.

(3) Cotton seed germinates worse than any of the other seed, and this is due perhaps to seed being bought from local ginning mills. Probably the best solution of this very difficult but very serious question of the supply of good cotton seed lies in what I have described in my first report on the examination of the seed supply of the Broach district as the '*Detral*' system of co-operation. This is a method of securing good seed introduced spontaneously by the cultivators of this village with excellent results, and is one of the best examples of the success of a co-operative system among Indian villagers. It simply consists in the cultivators of a village, as a whole, making arrangements with a neighbouring gin to treat their seed cotton separately. Each farmer in the village picks the best bolls of the seed cotton from his farm and adds it to the lot similarly picked by the other farmers of the village. The whole lot is then taken to Broach, ginned separately in a local factory, the manager of which has arranged to return the seed to the farmers without allowing it to be mixed with any other seed. This is only possible because the total quantity supplied for this purpose by the co-operation of the villagers is large enough to justify this care on the part of the gin-owner. The seed after ginning is then divided among the farmers according to their share of the seed cotton and this seed alone is used for the next year's sowing.

This method of co-operating to maintain the purity and quality of cotton seed which has been evolved on the spot is worthy of attention, and it seems as if a similar system introduced elsewhere in the Presidency is the most feasible method of remedying the present state of things.

(4) Weevil attack acts very prejudicially on the actual value of the seed. Owing to the seriousness of weevil attack in pulse seed, an

attempt was made to see whether this could not be entirely prevented by smearing with a heavy petroleum oil in small quantity. While this was injurious to the germination with cereal seeds, it seemed to do no harm to the pulses, and may lead to a satisfactory method of storing these for purposes of future sowing.

(5) We have no special seed merchants, and taking into consideration the general lack of information, enterprise, and capital, I do not think, it will be easy to induce any private firm to undertake the business. The real solution will be found only when the cultivator becomes his own seed merchant. This may be achieved by following the line of co-operation adopted by the farmers of Detral as described above. It would seem extremely desirable that any movement in this direction should be encouraged, with cotton seed in the first place, but ultimately with the seeds of number of the other crops grown in the Presidency. Co-operation among the farmers when once started for one purpose will soon enlarge its scope and take within its bounds other important heads in farming. Already existing Agricultural Associations might perhaps move in this direction.

S Ag students selecting Seedlings for transplanting

The Novice's Experiences of Agriculture

BY

A. Novice.

THIS article has been inspired by the illustration accompanying it, reproduced from a photograph kindly taken by Mr. Godbole of the second year class at the agricultural college, when the students of his own year were toiling on the farm, full of the enthusiasm and *spirit which a new undertaking kindles in an apprentice. The students* are seen engaged in transplanting onions and the picture serves as a memento to them of their work and ought to recall happy memories when, to beguile their leisure moments during the vacation, they turn to the pages of the Magazine.

"In the sweat of thy brow thou shalt earn thy bread" was the charge to man by his Maker, when He sent him forth into the wide world—a charge whose fulfilment is in no one better displayed than in the sweating farmer. The students of agriculture at the Agricultural College are not merely told of this, in the course of lectures, as a theoretical fact; they are apportioned a task by means of which they can personally experiment and learn, for a surety, the lot of the farmer.

Theory constitutes a large portion of the agricultural course but the practical work forms its chief factor. Of all their concerns to the second year students, for example, their little plots are their greatest care, causing them as much anxiety as his own large fields as to a wealthy *Sowkar*. It is the practical training in the farmer's line, that makes the students seeking their education at the Agricultural College to know, when they have passed the course, not only scientific agriculture and how to improve the present methods on scientific principles, but what is more important to know the difficulties and intricacies connected with success in this great industry. The College sends them forth with an education boon of experience—an education which instils into them the right feeling they should have towards the farmer and his occupation.

The toil on the farm results to the students who engage in it that agriculture is not all an easy path to happiness. It teaches them what care and alertness are necessary for real success. They sowed as the monsoon crop—Broach cotton—well selected by Prof. Knight to enable them to realise the care and management of a crop most susceptible to good treatment. They took up the work with alacrity and prepared the land by means of several harrowings and manure till the rains allowed the seed to be sown. Though it was a first venture, the sowing in rows was fairly well done. But all the labour seemed doomed to be of no avail for the rains failed. To help the tender plants against starvation under these circumstances, the students had to make an attempt to conserve at least the little moisture present in the soil. They effected it in some measure by interculturing the soil. Yet a more timely recourse to this may have proved much more successful and prevented the hard pan that was gradually forming in the lower layers of the soil. Another trouble arose, occasionally, in the shape of pests which bred freely; and hence at the end of the year they had to bear the disappointment of a poor cotton yield both in quantity and quality. What has been the lesson? To be prepared for all emergencies and to readily to task their wits to meet them boldly.

The cold weather crop was onions. The seeds sown in clean, well manured and well prepared beds at the end of September, with a regular irrigation at the hands of the students every ten days, were ready for transplantation about the beginning of November. Here again the *students put forth their best energies to get ready a series of well pre*pared beds for seedlings to be transplanted and when all was ready the work of transplanting commenced. It may be rightly said that the importance of economy of time, the rapid use of hands and legs, the principles of proper irrigation could never have been better studied than in the course of this operation. And above all the co-operative system on which all the plots were worked at, was a demonstration—obvious in itself—of its absolute need in agriculture. The daily labour of six to eight hours for several days in succession gave the students to know what it means to work in the fields, difficult assuredly yet causing silent satisfaction to the heart at the end of a good days' work.

For all their endeavours, the plots seemed to be thriving well and appeared to compensate for the disappointment over the cotton crop.

With irrigation every ten days and clean weeding, the whole series of plots had a fine look of greenery. But here again, when almost at the end of their labours an insect pest—the thrips—comes to mar its success. The cause of this invasion is difficult to ascertain but it came at a time when the preliminary examinations occupied the hands and attention of the students. Timely remedy could not be given to prevent its spread and further invasion. Again, a lesson how every moment the farmer must attend to his fields to prevent the force of nature's surprise attacks.

"There's a perennial nobleness and even sacredness in work" says Carlyle. Amidst the burden and difficulties of class work, the farm work required of the students has been to them a source of deep concern and they undertook it right heartily in the hopes of bright prospects and brilliant success The year seems to have been especially hard on them, yet their honest work, let us trust, has not been in vain. The nobleness of their work remains. They have attained from it a lesson of world— wide importance—sympathy for the hard pressed labourers in the fields. This is indeed a matter of congratulation to them.

College News and Notes.

WE have to tender an apology to our subscribers for the delay in the issue of the last number of the Magazine. The delay was caused by the very late arrival of one of the picture blocks that was ordered. We regret also that the present issue is not out in time, though for different reasons. The managers and editors have had very little leisure to spare, consequent on the approach of the University examinations. Though late, they have tried their best not to tax the patience of their readers by getting the number ready as soon as they possibly could. We trust that this will plead enough for them and that our subscribers will not think ill of us for having kept them waiting.

The present number winds up the Third Volume of the Magazine and we are glad to say at this stage that its popularity has been evinced by the large addition during the course of the year to the list of its subscribers. With this issue, the college activities also cease till June. The college course ended on January 30th, and on the 1st of February the preliminary examinations commenced—much later than usual. They continued up to the 15th, and as the final examinations have not been postponed simultaneously with the extension of the term, we have not had the usual length of time to get into thorough trim for them. The preliminary examinations were held in the College hall. The surroundings and the strict discipline made us believe we were actually in the University. The results give us hopes to see some very good successes in the final examinations, and also a good average on the whole if, as undoubtedly will be done, the best possible use is made of the little time that is left.

The general topic just now is "Have you finished your portion." This constant reminder, one to another, does necessarily induce one to give himself and the questioner, a satisfactory answer as soon as possible. It is our ardent wish that by the 11th of March a broad smile and

a sincere "yes" will be the answer of all when they meet at the University for the test match. We wish that every one will have pleasant times in Bombay during the examination week.

The special students of all the classes have this year an examination in addition to the preliminary. The examinations commenced on the 28th, February and will continue till the 8th of March. The training of the special students is in every way equal to that of the University ones, an equal standard being also required of them in the examinations.

The short course students have also completed their course and most of them have fared very well in the certificate examinations.

We expect to have among us some more students from Ceylon as the Ceylon government have instituted four scholarships to enable enthusiasts in agriculture to receive a thorough training at the Agricultural College here. It makes us proud that our College has been chosen for the purpose by the Ceylon government, and we feel assured that the new-comers will find themselves comfortable here in every respect. We have already two young men from Ceylon who are now thoroughly acclimatised and who have derived a distinct benefit from all they that have learnt of Indian agriculture.

We are extremely glad to see the names of Messrs. Ramrao Kasargode and H. K. Mehta as Examiners in Entomology and Physics for the Examinations in Agriculture. While congratulating them, we hope to see them holding the honour for many years to come. Mr. G.D. Mehta was already last year Examiner in Chemistry and we are glad to see him appointed the same again.

To give a glimpse now at the past quarter, there was nothing in particular enacted except that the students met in a general assembly to discuss and settle upon the principles to be adopted in the distribution of the medals presented by our esteemed friend Mr. Fazal Haque Ahmed, of which mention has already been made in a past issue. As

desired by him, the medals are to be known as the Ahmed-Mann medals. He also, with the idea of inducing thorough fellow-feeling among students, and also of creating a desire in them for furthering the interests and maintaining the prestige of the College laid down several conditions for competition. The term public-spirit embodies all that is contained in them. He left it, however, to Dr. Mann to adopt the best method for selection of students for the honour. The meeting was therefore called by Dr. Mann for this purpose and it was resolved after much discussion that every individual member of each class should vote by ballot for three men from his class fulfilling the required conditions; that from these, the first three with the highest number of votes should be selected and that a special committee composed of the three professors, Mr. Sahasrabuddhe, the general secretary, and one student selected by the Principal to represent each class should make the final selection from these nominated by the students. This principle enables the students to send up for nomination those most popular, and prevents any unpleasantness by allowing the staff to give their judgment. There was a pretty great enthusiasm over the whole affair and among those sent up for nomination by the students, Messrs. Bhadkamkar, Lobo and Masani were selected as medallists for the B. Ag., S. Ag. and F. Ag., classes respectively. This honour, the first of its kind among us, ought to stimulate every one of us to put forth our best energies for the glory of our *Alma Mater*. The honour is a weighty one and of just the kind to infuse into the students a love for the institution, that is trying to make men of them, a sense of feeling and sympathy for their fellows and an endeavour to build up a character, which will command the reverence of all, when they leave the portals of the college, and which will reflect the greatest credit and honour on the institution which has educated them. We have no doubt that it will be the desire of every one in years to come to join in healthy and strenuous competition for the prize.

We cannot but offer our heart-felt thanks to Mr. Fazal Haque for his supreme public-spiritedness in making the presentation. He will be glad to learn of the success with which the first nominations for the medals have been made, and to know that the medals are and will ever remain a subject of the deepest interest and great pride at the college.

In connection with prizes, we feel happy in having to record the University honour gained by Mr. C. V. Sane, Demonstrator on the College Farm. He has been given the Ashburner prize for an essay on the 'Improvement of Indian cattle'. The recognition of the essay by the University is a distinct proof of the value of the information it contains and the principles for improvement it lays down. Mr. Sane's essay on the "Increase of Indian cattle" has been published in the second volume of the Magazine, for which he has earned the prize and it ought to be a matter of great satisfaction to him as it sincerely is to us all on the further distinction conferred upon him for a very original work.

Soon after the preliminary examinations Dr. Mann went on tour to the Ratnagiri district for the examination of the hot springs existing there. He was absent from us for a fortnight. He has we are sure collected a mass of material, in the course of his scrutinizing examination, which will prove of great value in the line of research.

Mr. Burns will shortly be going home on three months leave. We wish him a safe voyage home and a speedy return to the College, full of new vigour and health to resume his scholastic and social duties among us. He is truly the life of the College as much in the class as on the playground, and were it not that we too will be away for the vacations, we would have missed his presence very much.

Mr. Knight has recently studied, after deal of experimenting, a point in connection with the working of the English plough which will revolutionise all the ideas and methods hitherto followed upon. He has found that good ploughing can only be effected by "balancing" the plough. This "balancing" requires a practical study though theoretically it may be put down as the steady and easy working of the plough full on its shoe. The subject has become all important to the students who may be daily seen working at the ploughs on this principle. A new set of ploughs, manufactured by the firm of Rud Sack of Germany, have recently been brought to the Farm and their working experimented upon. Mr. Rud Sack himself has been honouring us with a visit and giving demonstrations with his ploughs. They have proved their efficiency for our soils and will probably be soon introduced.

A serious insect pest has recently visited our Farm. The thrips have attacked all the onion plots causing considerable damage. Luckily however, their advent has been when the onions bulbs have on the whole sufficiently developed. The outturn must necessarily be very much affected. The cause of this invasion is not definitely known. It is in fact the first occurrence of its kind on the Farm.

The senior manager and editor are at the end of their course and will leave us shortly. At least we expect them to do so in the prospect of their expected success in their examinations for the degree. We regret to think of their going away as they were most useful members of the Magazine Committee. Mr. Gokhale, as manager, has been the mainstay of the Magazine, working for it most arduously. His sincerity in its cause may be judged from the success our journal has attained during the year, in the increasing list of subscribers and the vastly improved finances. He deserves our special thanks and not less our editor to both of whom we hope we shall have the pleasure of offering our thanks again and congratulations in the next number.

Here we ask to be allowed to remind all our subscribers perticularly the students, that we are in great need of their co-operation for the up-keep of the Magazine. We ask the students especially to endeavour to send in contributions. Surely, we do not expect elaborate experiences and experiments from them, but they may occasionally find in the course of their observations or their study, something worthy of record. We rely on their making the best use of their holidays in the collection of material for articles which they might contribute. We should be very much pleased to see our students having sincerely at heart the success of the Magazine.

In conclusion, we thank the retiring Committee for their good work in the cause of the Magazine. All have rendered valuable help and they have certainly been well rewarded in the gradual spread of the Magazine.

While going to the Press, we hear with pleasure the appointment of Mr. R. S. Hiremath, B. Ag. in the Provincial service, as probation-

ary Deputy Collector. Mr. Hiremath was a brilliant student of the College and has always contributed to the up-keep of our Magazine. While congratulating Mr. Hiremath on his appointment, we wish him all success in the future. We hope to give a short account of Mr. Hiremath's career in the next number of *the Magazine*.

The College Gymkhana.

We must confess that an air of general passiveness has prevailed in this department during the quarter. It is natural, there should be some physical inertness when the mental activities are put to a severe test. Tennis however affords a good relaxation to the students after a hard day's work. The Reading room even has lost its patrons to say nothing of the other branches of the Gymkhana.

The Debating Society ended its proceedings with the lecture on the "Manurial resources of the Bombay Presidency and how they can be best utilized" by Mr. V. G. Gokhale, Superintendent of the Farm.

All the departments of Gymkhana, it may be said, have been successfully managed by the various secretaries to whom general thanks are due for their energy they have displayed. The task has been by no means an easy one for some of them, considering that they had to seek spare moments for it from their studies. Their work is all the more commendable for it

A final word for the Debating Society. We trust that the students will return in June determined to work earnestly for it. The Society is just the place to gain a bureau of information collected by the different lectures, and the only way to do justice to the exertions of the lecturers is for every student to do his best to be present for the meetings, and to enter into the spirit of the debates by boldly speaking his sentiments on the subjects under discussion.

If each student considers himself an important and necessary actor of the Society, we can surely hope to see this Society the best of its kind in all the Colleges in the Presidency.

VOL. IV.] JULY 1912. [No. 1.

THE

POONA AGRICULTURAL COLLEGE MAGAZINE.

POONA:

PRINTED AT THE "ARYA-BHUSHAN" PRESS, AND PUBLISHED AT POONA

By

Gangadhar Balvant Talvalkar.

1912.

Price Rs. 9.

THE

POONA AGRICULTURAL COLLEGE MAGAZINE.

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Notice to Contributors.

The Magazine is at the disposal of Professors, past and present students as well as outsiders having special interest in Agriculture. All contributions should be written legibly and on one side of the paper and are subject to such needful emendations as may be consistent with their ideas and rejected articles will not be returned.

The Magazine will be published as follows:—1st July, 1st October, 1st *January, 1st March and contributors are requested to send in their contributions* at least one month before the date of publication.

T. LOBO,
Editor,
POONA AGRICULTURAL COLLEGE MAGAZINE.

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CONTENTS.

NOTICE.

There is about 90 acres of good land available on easy terms, situated *near* Barsi-Road *Station,* which *offers* a *good opportunity,* for any Agricultural Graduate to commence Agricultural operations. Ground-nut, cotton, linseed, wheat &c. will succeed. There is a well on the plot. For further particulars apply to the Professor of Agriculture, Poona.

Poona Agricultural College,
Poona, July, 1912.

(Sd.) J. B. KNIGHT,
Professor of Agriculture.

S. V. S.

THE HONOURABLE THE CHIEF OF ICHALKARANJI.

(We present this month the portrait of one of the leading enthusiasts of Agricultural progress among the Chiefs and Sardars of the Deccan. The Hon the Chief of Ichalkaranji has for many years identified himself with Agricultural improvements. He took a leading part in the Provincial Agricultural Conference in Poona 1909 , he presided at the Marathi Conference organized by the Deccan Agricultural Association in 1910 He delivered the annual address to the Students of the Agricultural College in the same year, and has continued to show a very keen interest in the College and its development)

The Poona Agricultural College Magazine.

Editorial.

WE can hardly believe that the Poona Agricultural College Magazine, first issued with considerable trepidation in 1909 as a half yearly, has had reached its fourth volume. Each year has seen an increase in subscribers, and we think, also an improvement in the Magazine. Now, it has a circulation in almost every part of India, while copies also go to Europe and America. The students and staff have good reason, in our opinion to congratulate themselves on this public appreciation, which have made the Magazine a financial success. The volume of which this is the first number will be found, we hope, in no way behind its predecessors both in the interest and in the value of its contents.

In the present number we should like to call attention to several articles. The first of these is that on tests made in the draught of various ploughs, by Mr. S. B. Butani, recently Assistant Professor of Physics and Mathematics at the College. To ascertain the amount of work required to produce a similar result by the implements in ordinary use and by the most improved types is a matter of great importance. There have been, however, great difficulties in doing this. The method of yoking indigenous implements seemed to make it almost impossible to get exact data in their case. Mr. Butani has, however, worked out a method which seems perfectly satisfactory in comparing ploughs under similar conditions, and by a statistical treatment of the actual figures obtained he has arrived at very important conclusions. So far his figures only apply to two ploughs, but we hope that his successor will continue the work, and before long give us material which will place the future development of implements suitable to Western India on a sound basis.

We would also call attention to the paper on the cottons of Guzarat, for which we have to thank Mr. K. D. Kulkarni. Hitherto, we know of no similar close and detailed examination of the kinds of cotton grown in the various parts of the Guzarat districts. General statements have

usually sufficed. But now with the experience and observations of Mr. Kulkarni at our disposal, it will be possible to speak with far more confidence than before of questions relating to the cottons of Gujarat.

Another matter which is of some importance is dealt with by Messrs. Chibber and Kotwal, namely, the growth of waterplants. In some parts of India, and notably, we believe, in Kashmir, the water plant *Trapa bispinosa* is a very important culture in the large area of water which occur there,—and found a very valuable supply of foods. The areas of water in Western India are limited, but Mr. Kotwal has shown that a nearly related plant of the same genus is also cultivated in the Thana district, and appears to be very profitable. The matter is certainly worth the attention of those who want to exploit new sources of food supply, and of profitable agriculture.

But we suppose there is no matter on which questions are more often asked by cultivators in Western India than the improvement of the water-supply for irrigation. Wells form the greatest source of water for this purpose by far. But many wells are failures. Many are stopped because the rocks are such as to damp the energy of the owner of the land. Any apparatus which will make it easier in the least degree to get water with less difficulty is an important acquisition,—especially if it is within the means of small landowners and farmers. Mr. R. S. Inamdar describes in the present number a type of simple boring machine which has been used with success by the Dharwar Municipality, and which may have some future before it in places which lie under similar geological conditions.

As we write the present note (July 15th) the greater part of the Bombay Presidency has had fair rain. The Konkan, Gujarat, Kathiawar have promise at least of a fair season. With a large part of the Deccan it is far otherwise. Local rain has fallen,—but this has been very light. Many parts have not sown any crops whatever, though in a normal year these would have been in the ground by the middle of June. Fodder is at famine prices the quotation for *kadbi* in the Poona bazaar being Rs. 35 per one hundred small bundles. Cattle are dying and can be seen lying by the side of some of the main roads. We have heard of sheep being sold at one anna each,—with no buyers. And thus the situation is daily becoming more and more anxious. Before this number reaches our subscribers we still hope the situation may have changed. It is still not too late to secure good crops,—but every day the chance decreases.

PLATE II

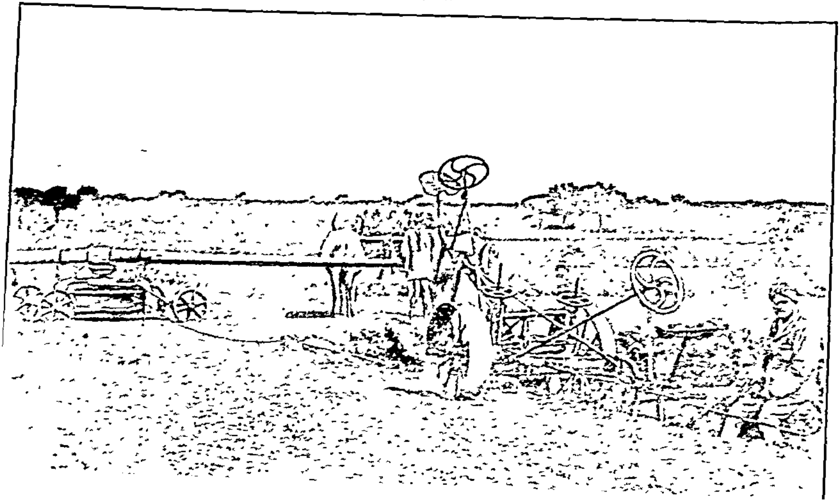
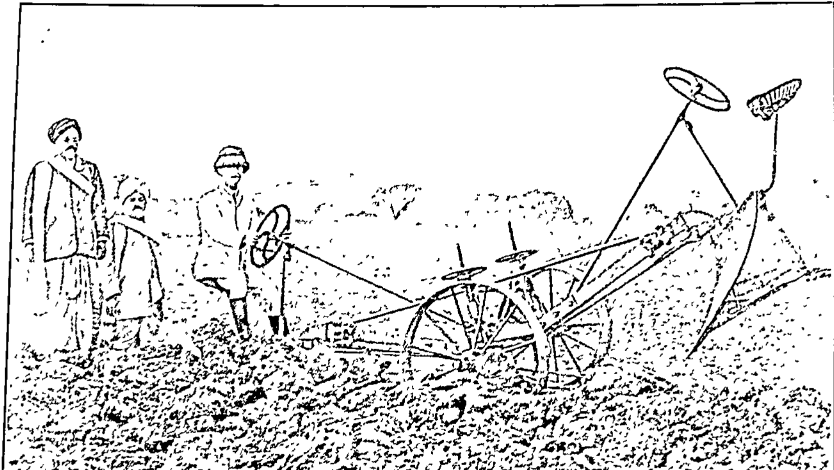


PLATE I.



"A New Plough for Deep-Ploughing."

BY

G. F. Keatinge, I. C. S., C. I. E.

DEEP-PLOUGHING.—The difficulty of ploughing deep by means of direct traction is well-known. It has been estimated that in some soils in Europe it requires 14 horses to plough 1 ft. 7 in. deep with direct traction, and that beyond this number of horses practically no advantage can be gained by adding further horses to the team, on account of the loss of power which must of necessity result when the team is increased. This difficulty is severely felt in some tracts of the Bombay Presidency where the cultivators habitually plough about 10 inches deep with the heavy wooden plough, and use up to 5 and 6 pair of oxen to do so. The same difficulty is found in many places by sugar-cane cultivators who wish to plough 1 ft. deep. The introduction of various patterns of turn-wrest plough has done much to solve the difficulty; but it has been found that there are some stiff black soils which are very difficult to plough in the hot weather, and that for eradicating *hariali* grass (*cynodon dactylon*) from deep black soils it is necessary to go deeper than a foot. The difficulty is greatly increased by the size of the clods of earth which are turned up by the plough; and which are so large and stiff that it is almost impossible for the cattle to walk over them. In order to tackle this problem the question of steam ploughing had been considered, but the difficulty of finding the funds (Rs. 40,000) for the trial was too great. It was, therefore, decided to try a large balance plough with two gearings, and the plough and gearings, as shown in the pictures, were ordered from A. Bajac, Liancourt (Oise), France. The cost was as follows:—

		Rs.
Two gearings with all accessories	... ...	1,875
Two small jack screws	... ...	62
One (breaking up) balance plough (weight 636 kilos)	... .	596
Painting, packing, etc.	... ...	238
Freight to Bombay ...	... ...	329
	TOTAL Rs. ...	3,100

The plough has been in use for two months in the black soil area in the south of the Bombay Presidency. It has two cables, each 230 yds. in length joining it to the gearing; so the gearings can be fixed up about 220 yds. apart, and the plough works slowly from one to the other, opening a furrow 16 in deep and 16 in. broad. It does very good work, and affords an excellent means of dealing with black soil infested with deep-rooted grasses. It offers an easy load with one pair of good bullocks on each gearing. The only thing against it is that it works very slowly. It ploughs 11 gunthas in 9 hours. This, of course, means a short day for the cattle since each pair will only be working for 4½ hours; and the working day might easily be extended so that one-third of an acre could be ploughed in the day. The possibility of working a two gang plough in this way will also be considered. Meantime the plough has met with the warm approval of large cultivators in the Dharwar District and many are desirous to hire the tackle at the rate of Rs. 3 a day and to work it with their own cattle and labourers. It is at present being hired out at Rs. 100 a month with a man to look after it.

Taking these rates, and the 9-hour day as a working basis, the net advantage to be gained by using this plough works out as follows. It will plough 11 acres in 40 days.

Hire of plough for 40 days at Rs 3 a day ...	.. Rs.	120
Wages of one man and two boys for 40 days at Re. 1 a day	"	40
Hire of 4 bullocks for 40 days at Rs. 2 a day ...	.. "	80
TOTAL ...	Rs.	240
Cost per acre ...	Rs.	22 (about)

The rates given above have purposely been pitched high, and the figure per acre is an outside one. If the plough is worked for six months in the year and Rs. 3 a day charged, it will bring in Rs. 540 a year, or about 17½ per cent. on outlay, which will allow amply for interest, depreciation and repairs.

As against Rs. 22 per acre for cleaning land by the plough the cost for hand digging is Rs. 40 per acre; and hand digging does not go so deep as the plough.

Water-Supply of the Eastern Bombay Karnatak and the "Boring instrument."

BY

R. S. Inamdar.

It is a matter of common experience to find gangs of people often emerging from the eastern parts of the Karnatak into the western parts to seek their food. The failure of crops induced by the uncertainty of rainfall is the chief cause of this. Irrigation facilities are rare in these tracts which, combined with the uncertainty of rainfall, results in careless cultivation. The cultivator unlike his western brother, feels doubtful as to whether his labour will be repaid at the end of the year, and contents himself with careless extensive cultivation. The benefit he gets, is in proportion to the labour he spends over his land. As a result of this we see the oft-recurring famines and the emergence of helpless people from these tracts into those which are better off in many respects. In a word, irrigation facilities are necessarily required in those tracts as it is beyond our means to control the rains.

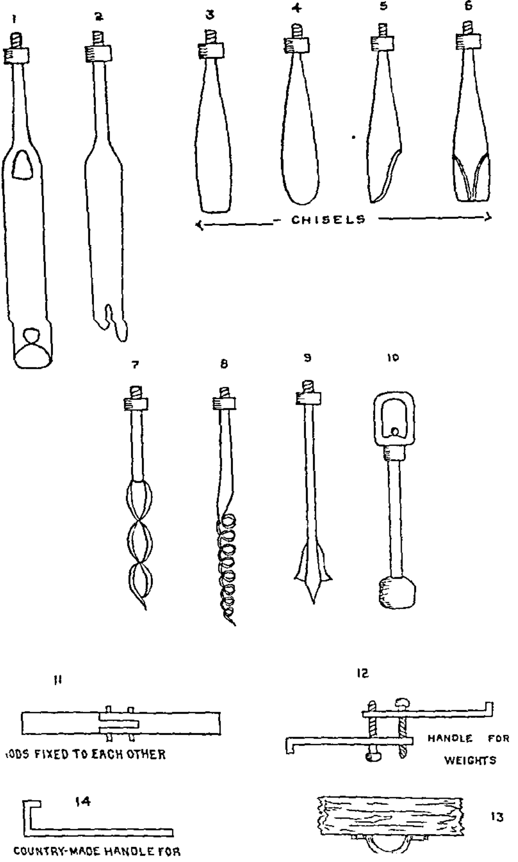
The extension of canal irrigation is restricted in many respects as it is mainly dependent upon great natural reservoirs. Recourse to well-irrigation will have to be had in their absence. But many difficulties have to be faced by the eastern cultivator in sinking a well in one of the strips of his holding. The chief of them may be analysed into two main factors, namely (1) capital and (2) uncertainty of obtaining the water even if the wells are sunk. The introduction of the *Tagai* system has removed much of the difficulty about capital. The cultivator, besides, will run into any depth to obtain the capital if he is assured of the certainty of the underground stream. But the main difficulty lies in the latter. Many devices for water-lifts have been made but we know comparatively little of the instruments which, with little cost, can trace an underground stream.

There is a sect of people which professes to understand the flow of underground water. But the attempts they make to indicate suitable spots for wells are often failures. The agricultural department has recently introduced a machine, the water-finder, which is constructed to trace the depth and the force of the underground current. Experiments as to its usefulness are under trial; and if it proves successful it

can be said that it will be of valuable help to those who wish to sink wells but who are frustrated in one or more attempts. We notice in many places in the east Karnatak in Dharwar, in Gadag and Ron Talukas and also near Bijapur, wells that have gone below fifty feet without a drop of water in them. In others the water-supply is scanty. Money is lost, labour is wasted and worst of all the cultivator is depressed If there be an instrument which with little cost can make trial borings and determine whether water can be got in a certain locality it will remove the greater part of the difficulty that lies in the path of the cultivators.

Such an instrument attracted my attention at Dharwar during the last summer vacation and it seems to give fair hopes. The following is a description of the instrument. It is being used for the municipal water-supply in Dharwar. It makes borings underground and hence is named the 'Boring instrument.' The borings are made in the existing wells which are more than 60 feet deep without a good supply of water. The scheme was to make borings underground till a forcible current was obtained which would furnish the well with a good water-supply. It has been successful in certain cases, and specially one well, 'the jubilee well' as it is called is supplied with a constant flow of water in a pipe three inches in diameter.

The instrument itself is of a very simple construction. It consists of a succession of iron rods each ten feet in length, two inches square in section, which can be fitted into each other by means of bolt and nut arrangement. At the end of this succession of rods a boring tool is attached. The boring tools are of different shapes modified for different strata. These can be clearly seen from the illustrations. Fig. 1 is a cylinder of strong sheet iron closed by a valve opening upwards, used in sand or loose earth. When the tool is working the valve opens and the sand or earth collects in the cylinder; but is hindered from falling by the valve It can also be used to clean the holes where chisels have been used. Fig. 2 represents an open auger and is used in clay and stiff soils; Figs. 3 and 4 are used in still harder strata. Figs. 5 and 6 are called S and T nose chisels respectively on account of their shape and are worked in rocky strata. The other parts of the instrument are mere accessories. There is a worm auger (Fig. 7) used before the cylinder for loosening the stuff in the bore-hole; a spiral worm (Fig. 8) for extracting broken rods; and a spring dart (Fig. 9) for bringing up pipes from the bore-hole. An iron rod with a swivel at the top as represented in Fig. 10 is fixed at the top end of the succession of rods to facilitate the lifting of the whole instrument at work.


1
2
3
4
5
6
CHISELS
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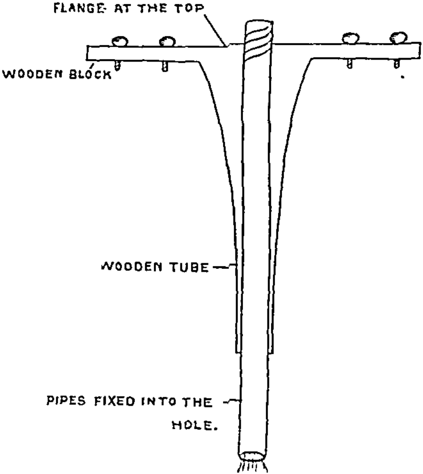
10
11
ODS FIXED TO EACH OTHER
12
HANDLE FOR
WEIGHTS
14
13
COUNTRY-MADE HANDLE FOR

15



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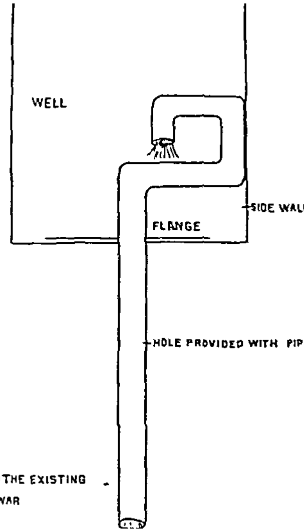
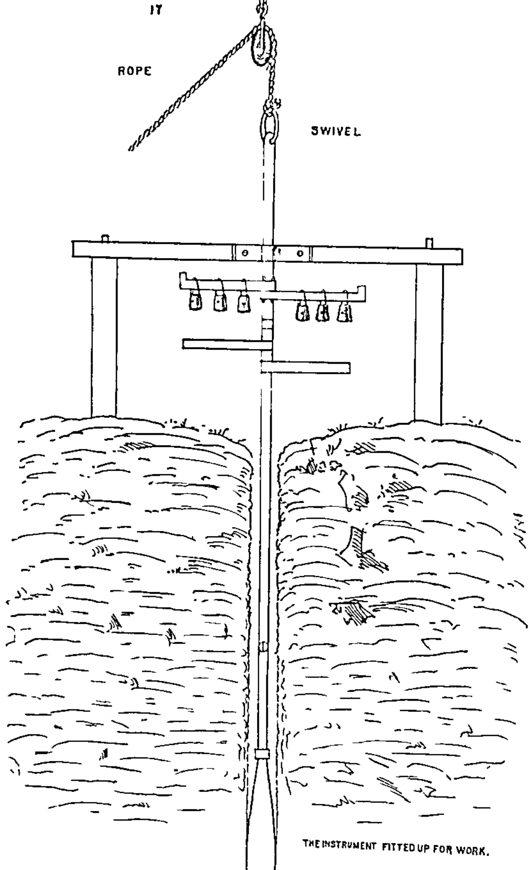


PIPS FIXED INTO THE EXISTING WELLS AT DHARWAR



THE INSTRUMENT FITTED UP FOR WORK.

When the work is to be commenced, two posts are erected at a distance of ten feet from each other and a third is fixed across them at a height of six feet from the ground. If the boring is to be made in the existing well as at Dharwar the third post can be inserted across the well in two holes made in the side-walls In the middle of this third post there is a clip which attaches the swivel-rod having a chisel suited for the stratum at the lower end. The clip with a portion of the post is shown in Fig. 13. A pair of handles with screws for attachment as represented in Fig. 12 are then fixed to the swivel-rod just below the cross-post, with weights of nearly one maund on each side. Three special handles are then fixed below these handles and are turned round by three men. Fig. 17 represents the whole instrument fitted up for work.

The boring tools are to be changed now and then whenever a new stratum or when the stuff in the hole is to be loosened and removed. A fresh iron rod will have to be fixed between the swivel-rod and the boring tool when it has worked to a sufficient depth. The instrument will have to be lifted up during these operations by means of a rope passing over a pulley through the swivel.

When the boring is to be made in firm land no precaution against the sides falling in are necessary; but if the boring passes through sand or loose mud a case of pipes must be provided. These pipes are of the same diameters as the bore-hole and are 12 to 19 feet in length. Before the pipes are lowered down, the hole is widened a little in a slanting position and a wooden tube two feet long, of the same shape and size and with a square block at the top is fitted in it. The pipes are lowered to the required depth the top-most one being held by a square flenge resting upon the wooden block. Fig. 16 gives an idea of this arrangement. When the borings are made in the centre of the wells, a U shaped pipe attached to the screw at the top of the flenge and taken along the side wall prevents the hole from being choked up by the external dirt. This arrangement is shown in Fig. 15.

The direct advantages that can be had from this instrument are two. The one is that it helps us to compare the depths of the underground currents at two or three places and to choose the least expensive one. The other depends upon the principle of "Artesian wells". It is a well-known fact that water keeps its own level. Every underground current descends down from a higher or a lower level on the surface of the earth between two layers impervious to water. If one of these layers is broken, the water forces itself up to a height nearly equal to that of its descent. This instrument reveals to us the

level to which the water can spring. A well sunk down to this level and a bore-hole further furnishes the well with the proper water-supply and still the labour is economised.

The initial cost of the instrument is Rs. 400. The depreciation on this at ten per cent and the interest at twelve per cent amount to Rs. 88 per annum. Taking the average working days to be one hundred and twenty, the rent on which the instrument can safely be given with a clear profit of Rs 60 for the working season, comes to Re. 1-4-0 per day. The daily working cost is the labour spent by three men amounting to fifteen annas. The capacity of the instrument mainly depends upon the stratum. On an average it is said to have worked five feet in a day at Dharwar. Taking this into account we find that seven annas was the cost of boring a hole one foot deep. The usual rent at Dharwar is Re. 1 a day.

Such is the instrument which seems to give fair hopes if it is tried on a large scale in the east Karnatak. The initial cost prohibits an ordinary cultivator from buying the instrument. There is, secondly, the difficulty of obtaining the work for the whole season within the narrow circle of a private cultivator. Lastly it is to be tried and demonstrated before it is adopted by the cultivators. These things require that the work of trial and demonstration should be taken up by a landlord, a firm or by the Agricultural department who alone can carry on the work efficiently. If this instrument proves a success and if it is introduced into the eastern part we may hope to see a less number of people leaving these tracts and the whole aspect of agriculture changed within a few years.

The Draught of Ploughs.

BY

S B Butani, M. A. B. Sc,

Late Assistant Professor of Physics and Mathematics,

Poona Agricultural College.

THE question of the draught and ease of working is of great importance, perhaps of chief importance, in deciding whether it is worth while to replace the cheap non-turnover plough still in use almost universally in India, by one of the modern type, which is entirely used in Europe and America. It is not altogether easy to compare them; however, the difficulties have been surmounted by Mr. Butani, and he gives an account of his methods and preliminary results in the following article. Owing to his leaving the college, his work will probably have to be taken up by others,—but he has, in these preliminary experiments, shown how a satisfactory comparison between the different instruments can be made.—H. H. Mann.

The following preliminary experiments were made at the Poona Agricultural College Farm with a view to being able ultimately to make a comparison between the country ploughs and the modern English and American ploughs.

Experiments were first made with Messrs. Ransomes Sims and Jeffries' plough marked B. T. 2.

Method of Experiment.—The soil chosen was medium black soil, under cultivation. Straight lines parallel to one another and at a distance of 5 ft. from one another were marked on the soil with lime powder; there were 21 such, so that the distance between the first and the last was 100 ft.

The plough was yoked to the bullocks in the usual way. A dynamometer was used; it was placed at a point A, shown in the diagram below, such that its distance from the point B, the beginning of the mould board, was 5 ft.

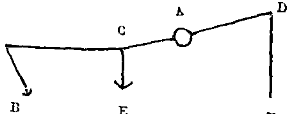


Fig. I.

The reading of the dynamometer was noted down each time that the dynamometer was above a lime-marked line; this gave 20 readings in each run of the bullocks, as the dynamometer was never above the first line; sometimes it was necessary to reject several of these for want of certainty; in such cases, the places in the record book where those readings would have occurred were left blank.

The depths of the furrows at each of the lime-marked lines except the last were then determined; this gave twenty depths in each run corresponding to the twenty pulls, those corresponding to the blank, were rejected.

The distances CD, CE and DF were measured, the last two being the heights of the points C and D above the ground and the first being the total length of the chain used. In all the experiments, these distances were the same.

Results.—Table 1 shows the results of the experiments. In all, 291 readings were taken and corresponding to them 291 depths were measured. The horizontal row of totals shows that the pull of 2 cwts. occurred nine times, the pull of 2·5 cwts. occurred sixteen times &c. The pull of 3 cwts. is evidently the most frequent, being therefore the mode; its frequency is 142.

The second vertical column shows that of the nine pulls, each of 2 cwts., five had a depth of 2 ins. corresponding to them, one, a depth of 2·5 ins. corresponding to it, and three, a depth of 3 ins. corresponding to them, the depths being given in the first vertical column. Of the 142 pulls of 3 cwts. each, we see, eight had a depth of 2 ins. corresponding to them, 39, a depth of 2·5 ins., 51, a depth of 3 ins., 36, a depth of 3·5 ins., seven, a depth of 4 ins., and one, a depth of 4·5 ins.

The horizontal row of means shows that 2·4 ins. is the mean depth associated with the pull of 2 cwts., 2·8 ins. is the mean depth associated with the pull of 2·5 cwts. &c. This is calculated in th usual way of calculating the mean. For instance, in the case of the pull most frequently found (mode), the mean, X, is found by the equation:—

$$142\,X = 8 \times 2 + 39 \times 2{\cdot}5 + 51 \times 3 + 36 \times 3{\cdot}5 + 7 \times 4 + 1 \times 4{\cdot}5.$$

The horizontal row of standard deviations shows how far the actual depths deviate or differ from the mean depth. The standard deviation in each case is found thus :—Taking the pull most frequently found (mode), the standard deviation Y, is found by the equation :—

$$142\,Y^2 = 8\,(3 \backsim 2)^2 + 39\,(3 \backsim 2{\cdot}5)^2 + 51\,(3 \backsim 3)^2 + 36\,(3 \backsim 3{\cdot}5)^2 + 7\,(3 \backsim 4)^2 + 1\,(3 \backsim 4{\cdot}5)^2.$$

The vertical column of totals shows that in all the 291 depths, here were 15 of 2 ins. each, 52 of 2·5 ins. each &c. Here the depth of 3 ins. is the most frequent, being therefore the "mode"; its frequency is 106.

The second horizontal row shows that of the 15 depths of 2 ins. each, 5 have a pull of 2 cwts. associated with them, 1, a pull of 2·5 cwts. associated with it, 8 a pull of 3 cwts., and 1, a pull of 3·5 cwts. Of the 106 depths, of 3 ins. each, 3 have a pull of 2 cwts. associated with them, 6 a pull of 2·5 cwts, 51, a pull of 3 cwts., 27, a pull of 3·5 cwts., 16, a pull of 4 cwts., 2, a pull of 4·5 cwts. and 1, a pull of 5 cwts.

The vertical column of means shows that 2·7 cwts. is the mean pull associated with the depth of 2 ins., 3 cwts. is the mean pull associated with the depth of 2·5 ins., etc. This is calculated in the usual way. For instance, in the case of the mode, the mean, X, is found by the equation :—

$$106\,X = 3 \times 2 + 6 \times 2{\cdot}5 + 51 \times 3 + 27 \times 3{\cdot}5 + 16 \times 4 + 2 \times 4{\cdot}5 + 1 \times 5.$$

The vertical column of standard deviations shows how far the actual pulls deviate or differ from the mean pull. The standard deviation in each case is found thus:—Taking the mode, the standard deviation, Y, is given by the equation :—

$$106\,Y^2 = 3\,(3{\cdot}3 \backsim 2)^2 + 6\,(3{\cdot}3 \backsim 2{\cdot}5)^2 + 51\,(3{\cdot}3 \backsim 3)^2 + 27\,(3{\cdot}3 \backsim 3{\cdot}5)^2 + 16\,(3{\cdot}3 \backsim 4)^2 + 2\,(3{\cdot}3 \backsim 4{\cdot}5)^2 + 1\,(3{\cdot}3 \backsim 5)^2.$$

Fig. II shows the relation between the pull as measured on the dynamometer in the direction C D and the pull in the horizontal

direction D G, the direction in which the bullocks may be assumed to apply the force.

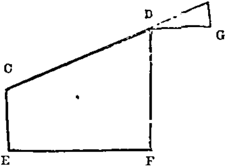
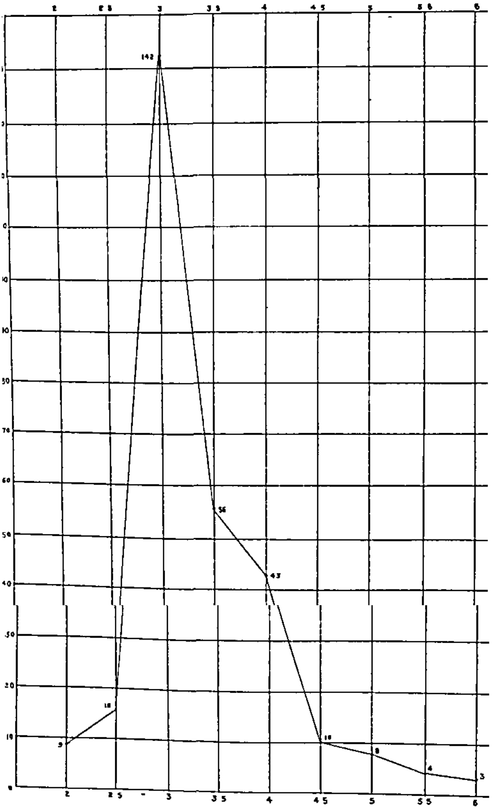


Fig. II.

Fig. III represents, graphically, the frequencies of the pulls. Each small division along the horizontal line represents ·1 cwt.; each small division along the vertical lines represents the number 2.

Table I.—Pull of 3 cwts. per 25·5 sq. ins. or ·118 cwts. or 13·22 lbs. per sq. inch

Cwts.	2	2·5	3	3·5	4	4·5	5	5·5	6	Total	Mean	Standard Deviation
Ins. 2	5	1	8	1					.	15	2·7	·51
2·5	1	7	39	6						53	3	·45
3	3	6	51	27	16	2	1	.	.	106	3·3	·5
3·5		1	36	21	14	5	1		1	79	3·5	·58
4 ..		1	7	1	10	3	4	3	2	31	4·2	·95
4·5			1		1	...	2	..		4	4·2	·83
5 ..					2			1		3	4·5	·71
Total	9	16	142	56	43	10	8	4	3	291	3·4	·69
Mean	2·4	2·8	3	3·1	3·5	3·55	3·9	4·2	3·8	3·1		
Standard Deviation	·46	·46	·50	·37	·53	·35	·46	·44	·21	·57		



142
56
43
18
9
4
3
2
2 5
3
3 5
4
4 5
5
5 5
6

Experiments were next made with the heavy Poona plough.

Method of experiment.—The soil was the same as before; the plot of ground different but very near. Lines were marked out as before.

The plough was yoked to the bullocks in the usual way. Two dynamometers were used. Their positions are shown by the following diagram:—

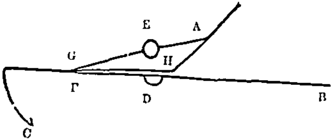


Fig. IV.

A and B are the places where yokes go; D and E are the spring very nearly one over the other; the distance between them and C the point of the iron piece is 5 ft.; D is slightly hidden by the wooden piece, but as observations were made by walking between the wooden piece and one of the bullocks at A, while the plough moved on, no special difficulty was experienced in the making of the observations.

The readings were taken as before; with a little practice, one gets the power of reading both the dynamometers sufficiently accurately, at the same time. Depths were measured as before.

F in the above figure is the point whence the rope F B started. The length FB, and the heights of F and B above the ground were measured; in all the experiments these were allowed to remain the same.

G in the above figure is the point whence the chain GA started. The length GA, and the heights of C and A above the ground were measured; in all the experiments these were the same. H is the point where the wooden piece binds; the distances GH, and HA and the height of it above the ground were also measured.

Calculation of results.—(i) The pull in the rope FB as indicated by the dynamometer D was multiplied by a factor, *viz.*, 1·03. This was calculated thus:—

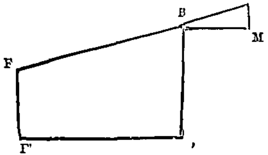


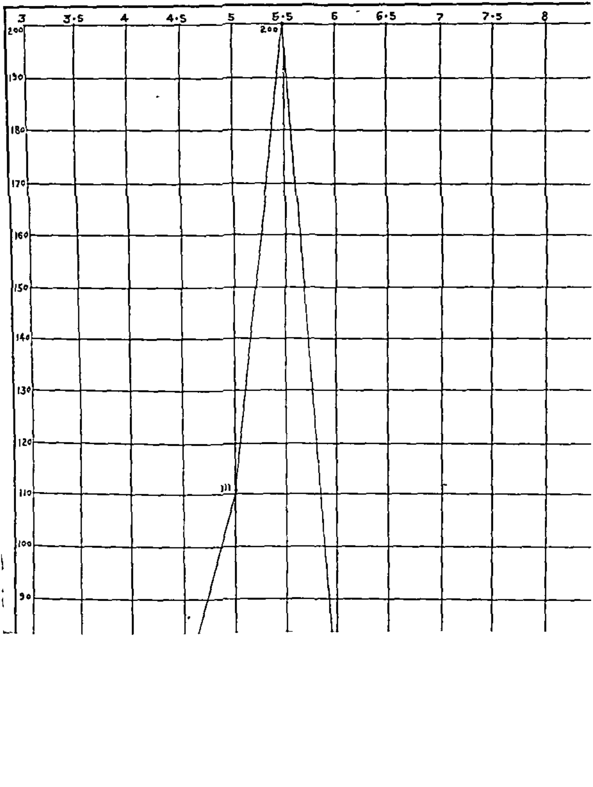
Fig. V.

The figure on the side gives the heights FF' and BB' of F and B above the ground, as also the distance FB. The pull along FB being known, the pull along BM the horizontal direction (along which the bullocks may be assumed to pull as before) is calculated graphically. The factor is 118/115 or 1·03.

TABLE II—(A) Pull of 5 5 cwts per 28 8 sq inches or 191 cwts or 21 39 lbs per sq inch
(B) Work of 2139 ft. lbs per 100 ft —1 sq inch,
3080 2 ft. lbs per 1 cubic ft

Cwts	3	3 5	4	4 5	5	5 5	6	6 5	7	7 5	8	8 5	Total	Mean	Stand Deviation
Ins 4	3	7	2					...	...				12	3 5	·32
4 5	2	2	4	2	3	1	1		—		.		15	4 3	·9
5	2	2	4	1	5	4						.	18	4 5	·84
5 5	...	3	7	32	23	18	9	4	1	.			97	5	·7
6	1	5	3	26	60	59	11	7	1	1			174	5 2	·64
6 5		...	1	12	13	74	20	18	7	2			147	5 7	65
7		.	..	1	2	22	18	17	2	2	1		65	6 0	62
7 5			.		4	16	7	15	13	6			61	6 3	74
8		...		...	1	6	4	9	11	11	3	3	48	6 9	86
Total	8	19	21	74	111	200	70	70	35	22	4	3	637	5 5	
Mean	4 6	4 9	5 2	5 8	6	6 4	6 6	6 9	7 3	7 5	7 7	8	6		
Standard Deviation	65	83	66	46	57	63	71	69	66	51	44	0			

(ii) There were two ways of interpreting the pull along the chain GA. Figure VI below shows one arrangement; figure VIII shows



3
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200
190
180
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200
111

another. In the first case the rod AB to which the bullocks directly apply their pull is nearly vertical; the arrow head near the rod shows

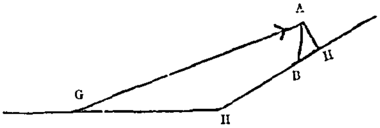


Fig. VI.

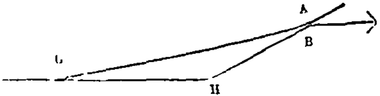


Fig. VIII.

the pull of the bullocks to be determined, when the pull along AG is known. If HH', H, A, AG, and GH are known, the determination would be easy. In the second case the rod touches AB and matter becomes still simpler. Then the heights of A and B above the ground alone need be known. These were 2 ft. 10 ins., and 1 ft. The distance GA was 5 ft. The factor in this case would be 1·08.

(iii) Each pull along FB in Fig. IV was multiplied by 1·03 and each pull along GA in Fig. IV was multiplied by 1·08. The two were added. These numbers were treated exactly as in the experiments with the Ransome's plough.

Results.—Table 1 shows the results which explain themselves.

Fig. VII represents graphically the frequencies of the pulls, the small divisions on the paper representing 1 cwt. and the number 2 as before.

(Mr. Butani has not attempted to compare the two ploughs on the basis of the figures he has obtained, but I think, that even at this stage some such attempt would be profitable. He has shown that working in the same medium black soil of the college farm, the Ransome's B. T.

2 plough gives a furrow 25·5 square inches in area and a pull of 3 cwts. is required in the most frequent case. The country plough in common use in Poona gives a furrow of 28·8 square inches in area, and requires a pull of 5·5 cwts. in the most frequent case. Thus, per square inch of soil opened the relationship is as follows :—

Ransome's B. T. 2 – 13·22 pounds.
Country plough – 21·39 pounds.

Perhaps it can be rendered still more clear by taking the actual cases where the furrow was 4, 4½ and 5 inches deep, and setting out the actual pull per square inch of furrow opened in each case. We have then as follows :—

Depth.	Ransome's *B.T.2* pounds per square inch.	*Country plough* pounds per square inch.	Draft of B. T. 2 plough, as percentage of country plough.
4 inches	13·66	21·50	64 per cent.
4½ inches	12·43	23·74	52 per cent.
5 inches	11·67	22·40	53 per cent.

It will thus be seen that *for equal work done*, the draught of the modern plough is only between fifty and sixty per cent of that of the country plough. This is only a first result, but it is sufficiently striking,—and would indicate that little more than half the bullock power would be required with the modern plough that is needed with that commonly in use by the cultivators.—H. H. Mann.)

Gujarat *versus* Karnatic Method of Sowing Cotton.

BY

Rao Saheb M. L. Kulkarni.

IN considering the problem of improvement in the present system of agriculture, it is important to observe minutely the existing methods of agricultural operations and to try to introduce the cheapest and the most effective. To stop waste of labour in agricultural operations is as good and as profitable an improvement as to investigate new scientific methods by which better crops can be raised. There are various ways in which agricultural labour is wasted at present. Our cultivators being accustomed to such wasteful methods do not mind the loss they are to suffer. Such losses though they seem slight when taken for each single operation cause a considerable amount of waste of labour when all such operations are put together.

The method of sowing cotton in the Karnatic is one of the instances of waste of labour as compared with the method practised in Gujrat. The two methods are therefore compared here and it is hoped that the cultivators of the Karnatic will soon adopt the improved Gujarat method for sowing cotton.

In the Karnatic, cotton is usually sown by a two coultered drill behind which are attached two bamboo tubes to the tines by thin ropes. The tines of the drill make narrow furrows and the tubes attached to the tines pass through these furrows and are fed by two men or women who hold the tubes by one hand and feed the same by the other.

In the method indicated above, not only is there waste of labour but also the seed is put most irregularly in the ground. The two men holding the tubes can be dispensed with, with least difficulty or inconvenience; and this would save at least 8 annas a day. Besides this waste of labour the sowing by this method becomes very uneven. One of the hands of the feeders of the tubes, is always engaged in holding the tubes. They are to feed the tube by one hand only which causes long gaps in the interval of taking seed from the bag or cloth tied to his waist. The gaps thus caused are sometimes 2 to 3 feet in length and such gaps occur at every 15 or 20 feet in each row. It can therefore be said that about 10 to 12 per cent of the area remains

unsown. Besides, the holes of the tubes being too small, it is very inconvenient for the feeders to drop the seeds uniformly at regular distances. This naturally causes thick sowing at certain places and thin at others. Thus the crop on the whole becomes most irregular and as there is no system in the Karnatic of thinning a crop as in Gujarat, the plants do not grow very vigorously and do not produce the best yield and of superior quality. The extraordinary leaf-dust which is found in the Kumpta cotton of the Karnatic seems due to the very thick planting of cotton.

To avoid the existing Karnatic method of sowing cotton, new drills were introduced from Gujarat at the Dharwar Agricultural Station in the year 1904. These drills are very satisfactorily working since their introduction on the farm.

The only difference between the Gujarat and the Karnatic cotton drills is that the bowl and tubes of the former are wider and thicker than those of the latter and consequently allow the thick seeds of cotton to pass easily through the tubes. Thus with a very slight modification in the existing seed bowl and tubes, cotton can be sown by drills themselves instead of attaching tubes behind them. Both the hands of the sower are free so that he can feed the bowl by one hand while his other hand is free to take seed from the seed bag. By this method of sowing there is a saving of one man in the work. Besides, the seeds are put regularly in the seed bowl by both hands alternately thus causing no gaps in the row.

Sometimes objections are raised by cultivators to sowing cotton seed direct through the seed bowls for the reason that the tines make very deep furrows and the cotton seeds are buried very deep in the ground and consequently do not germinate well. It is true that if the cotton seeds are buried very deep they do not germinate well especially in heavy black soils. But the deep falling of the seeds can be avoided very easily by inserting a ring made of cloth or a piece of coir or string at the end of the tines. This does not make the furrows deep at all and the seeds are sown at the required depth only. In this way very regular sowing and even germination of plants have been secured on the Dharwar Agricultural Station every year. The sowing of cotton seeds in this way direct through the bowls, is not only economical but increases the yield owing to the evenness in sowing and the absence of long gaps.

On the Dharwar farm there are now certain trained men who can manage both to drive the bullocks and sow the cotton seed themselves. There is however fear of the rows being very crooked and hence the work needs expert skill.

Among the methods indicated above the 2nd (*viz.* the Gujarat) seems to be the more economical and convenient. It is therefore hoped that all cotton cultivators will adopt this simple method by substituting a *bowl with wider holes and thicker tubes to the present* drills. Messrs. Kirloskar Bros. are manufacturing cast iron seed bowls with suitable iron tubes for sowing various sizes of grains from *rala to groundnuts.*

The drills used for sowing cotton on the Dharwar farm are always *open for inspection. Cultivators are invited to examine* these drills and get all their doubts cleared by the Superintendent who is always ready to solve difficulties.

Shingada (Trapa Bispinosa) in the Thana District.

BY

Mr. T. R. Kotwal, B. A. LL. B.

IN the Agricultural Journal of India for January 1909 pages 93,94, Mr. W. H. Harrison has given a short note on the Shingada cultivation. He has given the chemical analysis of a sample of the flour of the kernel of the Shingada. He has very briefly described the manner of its cultivation as given in the Dictionary of Economic Products by Watt. His closing remarks are "In view of the fact that the nut is nutritious and common throughout the country its cultivation may be recommended as forming a stand-by in bad seasons when crops might altogether fail."

Professor H. M. Chibber is carrying out the suggestion in practice by *making experiments of Shingada cultivation* in the Poona District. A personal interview with him and an opportunity to see the plants in the Ganeshkhind Botanical Gardens at Kirkee which were shown to me by Mr. G. B. Patwardhan, led me to make *enquiries,* about its cultivation in the Thana District, during the Easter holidays.

The Revenue Department keeps a list of the tanks and lakes in each village. This furnishes ready information to any one who wishes to extend the cultivation. In some places the tanks and lakes in a town are owned by Municipalities and they derive a revenue from the cultivation of Shingada, Poisar, and Kanals (Lotus).

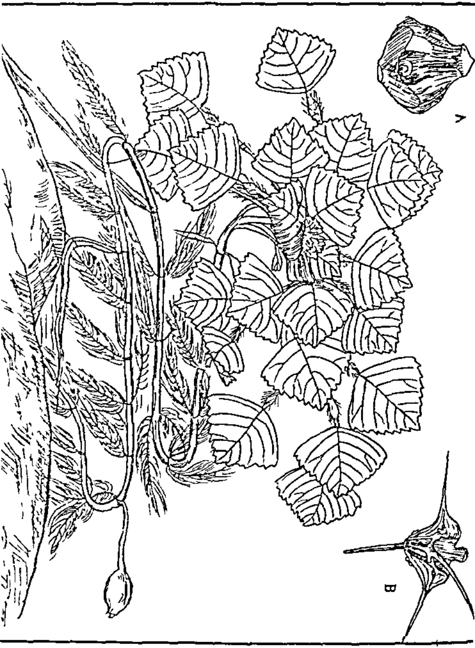
The writer discovered in his enquiries that the Bhiwandi Municipality derives an annual income of Rs. 10/- from one tank, whereas the Thana Municipality derives an income of about Rs. 2500/- for three years, as a result of competition among the growers of Shingada, when the original income from about 5 tanks was Rs. 150/- a year. All this indicates that the potentialities of the cultivation of Shingada in the Bombay Presidency are not a negligible quantity.

At present Shingadas are grown, among other places, at Dadar (Bombay), Matunga, Mahim, Panwel, Thana and Bhiwandi. The enumeration of places is by no means exhaustive.

The Thana and Bhiwandi Municipalities had taken written contracts from their lessees and the lessees pay the instalments without default. In Thana about 10% are deposited by the lessee and this deposit is taken into account with the last instalment and the balance is recovered by twelve equal monthly instalments. For the last 7 years one man named Dhokal Perdeshi is the lessee. He is a man from Northern India.

Probably the industry was introduced into this District after 1880 as the Gazetteer of the District makes no reference to the cultivation of Shingada. The Bombay Gazetteer newly published does not also mention Shingada in the index.

Seed :—Probably the seed was introduced into Bombay and Thana from Northern India by the Perdeshies or Bhayas. In my school days about 1881-82, my impression is that there were Shingadas in the Bhiwandi tank, which I visited this Easter in order to see personally the present cultivation. At present the Thana and Bhiwandi cultivators bring their seed from Dadar. One cart-load of the fresh plants or creepers costs Rs. 251/- or Rs. 2 to 2½ per head-load of the creepers. With proper care after the first cultivation, the grower of Shingada has his own creepers for the next season. Over-ripe fruit drop in the mud but sprout up again and are useful for fresh cultivation. It is said that the over-ripe fruit drops after Ashwin ($\frac{\text{October}}{\text{November}}$) and sprouts up in Falgun ($\frac{\text{March}}{\text{April}}$).



EXPLANATION.

Main figure—A plant of the spineless variety;

A. Immature fruit of the same;

B. Mature fruit of (Trapa natans), Kashmir variety.

Preparation for Cultivation :—The cultivators remove all moss from the tank and all grasses and clean the tank. The cost of this is 4 or 5 annas per labourer per day and the total cost depends upon the area of the tank available for cultivation, but cleaning cannot be neglected.

Cultivation :—The creepers are thrown in the water at a distance of about 10 ft. from each other. As the creepers have a luxuriant growth, if put too close to each other, they get entangled and check further growth. They then require thinning. Inexperienced cultivators waste their money in buying too many of these creepers, and at times those who have a stock of these creepers, refuse to sell any quantity less than a cart-load.

Growth :—The plants are thrown in the tank about the beginning of Ashadh (June). The plants begin to put forth blossom in Bhadrapada (August). The nuts begin to form in Ashwin (October, November) onwards and begin to ripen from Kartik (November) onwards. The full season lasts from two to three months and even continues till Magh (February).

Yield: —In the first two or three months the daily yield in one of the Thana tanks was two to three sacks a day. I could not ascertain the proportion of the area to the amount of yield of the crop. The informants could not be definite on these points.

Price and Market:—The Shingadas are sold green and raw in the towns of Thana and Bhiwandi or purchased by contractors from Bombay. The price is about an anna per pound. There is a good demand for the nuts.

Persons who cultivate them:—In Thana and Bhiwandi the Perdeshies from Northern India alone, or in partnership with others cultivate Shingadas. They have brought their knowledge and experience with them and have thus introduced a new crop into this District.

Enemies of the Crop:—In places where the tanks are shallow and the people ignorant and rude, the crop is in danger of being carried away in small quantities by thieves regularly. Where the water is deep and the tank has tortoises in it, these latter eat the leaves and fruits when tender and raw and do great damage to the crop. There are

insect pests to the crop which eat up the creeper, or eat the leaves and damage the weeds and thus lessen the crop. The insects are known to live gregariously and are called Kala Kid (Black-worm), Lalwa, &c.

I was not able to get a description of them and I had not time enough to investigate the matter further. The remedy as explained to me was the sprinkling of the tank with a small quantity of oil or Karanj seed.

The buffaloes when they enter the tank for a bath or a swim, damage the creepers by tearing them to pieces. Other cattle or sheep are not known to do any damage to the crop. Horses and asses feed upon the creepers in the green or dry state but they would not wet their feet to eat the crop.

Whether the crop will spoil the water:—At Bhiwandi and Thana when I visited the tanks, cattle were freely drinking water from the tanks covered with Shingada creepers. Opinion was divided as to whether the water would remain fit for human drinking purposes in a tank where Shingadas are grown. The best solution of this would seem to be to send the water for chemical analysis to get the matter authoritatively settled. This can also be ascertained from places where Shingadas are grown as a crop.

Extent of profit:—From conversation with the actual growers of Shingada in Bhiwandi and Thana as also with the Municipal servants and other gentlemen I came to the conclusion that an ordinary tank as is seen in Indian villages would yield Shingadas worth at least Rs. 300/- and calculating all costs at Rs. 200/- the net income is likely to be about Rs. 100/-.

Materials required for cultivation:—When the tanks are deep the cultivator requires boats for removing the moss, for sowing the creepers, for collecting the fruit and for removing the fallen leaves of trees along the banks of tanks. He requires a few bags or baskets for collecting the fruit and for carrying the crop to the market. A shed to watch the tank would or would not be a necessity according to the local circumstances and the nature and extent of the tank. In the Bhiwandi Taluka the names of several villages were given to me where there are suitable tanks for Shingada cultivation.

The thorns of the fruit which drop down in the water are a source of trouble when the lake is shallow and a man goes walking to collect the fruit. The covering of the creepers keeps the water of the tank very cool.

I have collected all this information on the spot first hand from the very cultivators of Shingada and cannot close the account without mentioning the incident at Thana of my conversation with Dhokal Perdeshi. At first he stated a few facts but got suspicions that I was collecting the information from him with a view probably to compete with him in the contract, or that I had some sinister motive in view and nothing could convince him that I was anxious to tell him of the sources from which he could get good creepers to improve his crop and prevent it from deterioration. My thanks are due to the Municipal servants and the Municipal counsellors who helped in introducing me to persons from whom I could get the information. I have narrated the above incident to show how delicate a task it is to gather information on any matter without raising the suspicions of those engaged in the industry.

Notes on the Cottons of Gujarat, and their Possible Improvement.

BY

K. D. Kulkarni,

Cotton Supervisor, Northern Division.

DURING the last two years I have had exceptional opportunities of visiting nearly all the important places in Gujarat and Kathiawar where cotton is grown, in connection with the cotton survey which is in progress. The notes taken during these trips, though not forming a continuous story in any way, may be found of some value and are given practically in their original form with this hope and anticipation.

As the cotton is of the best quality and pays better than *jowar*, cotton after cotton is taken for a long time by the people in this tract. The yield per acre is 600 lbs. of seed cotton.

The only improvement that seems possible in this tract is the adoption of a regular practice of careful seed selection.

5. *Navsari and round about Jalalpur.—Western side of the railway.*—Cotton of this taluka is grown on soils that are lighter in colour than the eastern tract, and the fibre is not so long or fine as that produced at Navsari. But it gives a little higher percentage of lint and those who care less for quality prefer this cotton. A higher ginning percentage is found in the seed cotton produced in the Era and Bhutsad villages especially.

Broach District.

1. *Jambusar Taluka.*—The soil is more than one-third *gorat* in this taluka, the remaining area being of the black type. Much of this black soil is situated to the west of Jambusar, while the eastern and northern parts of the taluka are for the most part *gorat*.

In *gorat* lands, cotton is generally grown in June. The lands are easily drained. In these lands cotton is rotated with *bajri*, or *til* and kodra.

In the black soils, cotton is generally grown at a later period when opportunity occurs in the rains. In these lands, cotton is rotated with *jowar*. The distance between two rows is from twenty-four to thirty inches. The type of cotton is usually *ghoghari* mixed with a few plants of *Deshi*. The yield per acre varies from 240 to 600 lbs. per acre.

Here no perennial variety is grown, nor is any irrigation given to cotton. As the cotton grown here is mostly *ghoghari*, there seems considerable possibility of improvement by growing fine Broach cotton in the black soils, while Cambodia will probably be successful in *gorat* soils.

2. *Amod Taluka.*—The rainfall here is greater than that at Jambusar. The land is mostly black though the *gorat* or *malcon* type is met with.

Cotton is generally grown at the same time on both types of soil in the month of July, either by a *Tirfin* or by a local seed drill having a distance of twenty-seven inches between two coulters. In the western part of the taluka the land is generally saltish.

In *gorat* lands cotton is rotated with *bajri* or *til* and *korda*, while in black soils it is rotated with *lang*, wheat or *shalu jowar*. Formerly it was usual to keep the land fallow frequently, but nowadays, owing to high prices of cotton many cultivators grow cotton without any rotation whatever year after year.

The crop is generally *ghoghari* slighty mixed with *Deshi*. The yield per acre varies from 200 to 250 lbs. The same remarks as to the possibilities of improvement already made on the Jambusar taluka also apply here.

3. *Vagra Taluka.*—The land from the Nahier village of the Amod Taluka to Vagra is black. Cotton here is usually sown late. *Lang*, *shalu jowar*, and wheat are cultivated. Cotton is sown by means of a seed drill with twenty-seven inches between the coulters. The rain is smaller in amount than in Amod but sufficien tly distributed for the growth of cotton.

The cotton grown is better in feel and length than that of Jambusar and Amod, as the cotton is mostly *De shi* mixed with *ghoghari*. Here the cotton crop is moderate, the yield varying from 200 to 450 lbs. per acre.

Here fine Broach, selected both for quantity and quality at Surat, is likely to meet with success.

4. *Vagra to Broach.*—In this tract cotton is rotated with *lang*, wheat or *shalu jowar* or sometimes a fallow or "partial fallow" system is observed. The partial fallow system means that the land between every two rows about four and a half to five feet is kept fallow, in which in the following year two lines of cotton will come. Thus, a cultivator takes cotton year after year without any necessity of any other rotation.

From Vagra as we approach the boundary of the Broach taluka, it is observed that there is continuously less mixture of *ghoghari* found with *Deshi*. Sometimes people grow the so-called *gundi-ghoghari* on account of its higher ginning percentage.

In the Broach taluka, the land is generally black and here a fallow system is practised. The cotton crop is *Deshi* Broach, mixed with *ghoghari*. Along the Narbada river the land is *bagayat*.

The yield per acre varies from 240 lbs. to 600 lbs. The cotton crop after fallow is better than that after *jowar*.

Looking to the soil and climatic conditions, fine Broach and No. 1018 P/G (Broach X Broach) selected at Surat are very likely to succeed here. Cambodia ought to be tried along the alluvial deposits of the Narbada river.

5. *Ankleshwar Taluka.*—The land is generally black, but is uneven, and is quite a change in this respect from that in the Broach taluka.

Cotton is generally rotated with *jowar*, and the yield varies from 200 to 500 lbs. per acre. It is mostly of the *Deshi* variety mixed with *ghoghari* in some fields.

In Hansot, at one time, wheat was chiefly grown, but now-a-days owing to the high rates of cotton, people are growing cotton on wheat lands also. Fine Broach and fresh Navsari seed are likely to prove a success in this taluka.

Baroda State.

(1) *Myagaum.*—Round about Myagaum, the cotton is of a similar kind to that cultivated in the Broach district. The soil is black like that of Surat, while the cotton crop, in good years, yields six hundred pounds of seed cotton per acre. The quality is a little inferior to that grown at Surat.

A two feet space is usually left between the rows of cotton, but sometimes the distance is greater, when another crop, such as rice or *kodra*, is taken between. This method of taking rice in cotton and keeping the distance more than two feet is peculiar to the tract we are discussing. Sometimes the land is kept completely fallow for one year and sometimes partially by taking cotton in rows ten feet apart.

A slight mixture of *ghoghari* is found here in the Broach *Deshi* cotton.

Jowar is always rotated with cotton though not exactly in alternate years.

(2) *Dabhoi.*—The tract round about Dabhoi is of black clay soil.

Here the amount of *ghoghari* cotton in the Broach locally cultivated is much greater than in the neighbourhood of Myagaum. Here, as a rule, the ginners insist strongly on white colour and high ginning percentage. As a result *ghoghari*, which possesses these two qualities is mixed intentionally. The yield per acre is about six hundred pounds of seed cotton per acre.

The length and fineness of cotton of this locality is inferior to that of Surat, and, hence, there is much scope for seed distribution of fine Broach, the land in some places being quite like Navsari. The only difficulty that will be experienced in distributing the improved seed of fine Broach is the slightly lower ginning percentage given by fine Broach, as compared with the local cotton.

(3) *Kalol to Kadi.*—This tract grows *wagad* cotton. It has not remained pure, as people for the sake of improving the colour of *wagad*, mix *lalio* seed when sowing, and *lalio* cotton being whiter than *Wagad*, the fibre looks better in colour. Also, in the neighbourhood of Kadi there is a mixture of *jari*, but this can be attributed to the *Wagad* seed being brought from gins, and not to its being mixed intentionally, as this variety has got the disadvantage of early ripening and thus requires separate picking. Furthermore, it has got a short fibre and thus makes the whole lot of *wagad* irregular.

In this tract the cultivators water the cotton crop like *Barla* and *Dhola* of the Ahmedabad District, and the yield of seed cotton of the irrigated crop is from one thousand to fourteen hundred pounds of seed cotton per acre, compared with six hundred or even only five hundred pounds in the dry crop area. The ginning percentage is also thirty-five and so the only improvement required here is selection of seed so as to avoid the mixture of *jari* from the fields. The land is a sandy loam. The rotation observed is wheat after *bajri* or *banti* in one year and cotton the next year.

(4) *Kalol to Mehsana.*—The tract from Kalol to Mehsana grows cotton less and less, as Mehsana is approached. The variety grown is *wagad* with a mixture of *lalio* but it was observed that there is half to half mixture of *lalio* with *lagad* near Mehsana, while in the neighbourhood of Kalol the amount of *lalio* is very small. The land is like that of Kadi, that is to say, a sandy loam near Mehsana while the cotton crop here is also watered like that of Kadi. At Mehsana we find here and there *rozi* cotton grown in rows wide apart with *bajri* in the middle.

Near Kolol the land is less sandy than in the neighbourhood of Mehsana and cotton is not irrigated, nor does it seem that there is any necessity for it as the land is a clay loam.

From Kalol to Mehsana castor is grown in the lines of cotton as *jowar* is grown with cotton in Khandesh. Of course as long as these

plants are far off they do not inconvenience the main crop and also may be beneficial as giving the benefit of a slight rotation where cotton after cotton is taken, but here in some fields castor is grown so much that it stunts the growth of the cotton, the main crop.

The ginning percentage of cotton near Mehsana is 34-35, while the length of the fibre is also good. The only suggestion to be made, therefore, is to observe selection of seed in order to avoid the slight mixture of *jari* and *malthio*, though the mixture with these inferior types is less than at Kadi. The yield per acre of dry and irrigated cotton is like that of Kadi.

At Mehsana, one peculiar method of cultivation consists in keeping the *wagad* cotton for two years, by cutting the first year's crop after harvest, and thus saving the trouble and expense of cultivation, while the yield also is not found inferior to that of the first year's crop.

Here the rotation of *bajri-banti* followed by wheat and next year cotton is the same as was observed at Kadi.

(5) *Patan.*—The tract round about Patan grows very little cotton of the *wagad* type and here also admixture with *lalio* is intentionally made to improve the colour of *wagad* cotton. The chief crops of this place are tobacco and wheat, while *bajri*, *tur*, *wal* &c., are mixed and sown in one field as in the Borsad taluka. This, the people say, pays better than cotton. The winter being severe here, the cotton crop becomes stunted as in the Dohad taluka of the Panch Mahals and thus this is hardly a place for the extension of cotton unless it be with an early ripening variety.

(6) *Wadnagar.*—The soil in the tract from Mehsana to Wadnagar is a sandy loam, and grows crops like those of Borsad, such as *bajri*, *wal*, castor, wheat &c. The land is not specially suited for cotton, and the winter being severe here, the crop will suffer. The only types of cotton which seem likely to give success are the Cambodia and the *bari*, with or without irrigation. These are at any rate, worth a trial, as they can be harvested before the very cold weather sets in.

Kaira District.

(1) *Thasara.*—Round about Thasara, the chief cultivation is that of rice. Most of the land is specially prepared for this crop alone, while the remainder usually bears tobacco or *bajri*, the latter in combination with cotton.

Tobacco grows here without irrigation on account of the heavy character of the soil, but if the late rains fail, the crop suffers. *Bajri* and *barto* are grown between the lines of *rozi* cotton. This cotton is not so bushy as many others of the local varieties, and hence gives more space for these cereals. As there are no wells in this neighbourhood, irrigation is out of the question.

The soil is *Goradu*, and heavy. From about thirty feet deep, there is heavy water bearing quicksand, and in this it is almost impossible to make wells.

Kahanmi or Broach cotton does not grow well here as the plants often decay, while *rozi* can withstand the conditions. If cotton is sown late in August here, the frost spoils the crop before it is ripe. *Rozi*, if damaged in this way, again improves in the following year, and it can also be sown in July.

If *Kahanmi* (Broach) cotton be sown in *goradu* soil this becomes very hard indeed, and moreover, this soil is the home of white ants, which do very much damage. The soil becomes so hard as to allow little cultivation after the rains are over. If Broach cotton is sown early, therefore, it decays, as has already been mentioned; if it is sown late, it gets no after cultivation. The yield of *Rozi* here is only two hundred pounds per acre in good seasons.

(2) *Dakor.*—The soil here is between black and *goradu*. The crops are similar to those of Thasara and the same remarks are applicable here.

On the way from Dakor to Anand the area under *rozi* cotton increases more and more up to Anand, but from Anand to Agas on the Cambay line it decreases again.

(3) *Borsad.*—The land round about Borsad is *goromti* or clay *goradu*.

The crops taken are tobacco, under well irrigation, and *bajri* and *kodra* with *rozi* cotton in rows.

The people will not grow any cotton here, as from tobacco they get treble the return they obtain from cotton, while dry lands can grow *barto*, *til*, *tur*, *ambadi* &c. in one field alone, to a value of about Rs. 80—per acre. So that annual cottons do not give a higher return than the ordinary dry crops, while the tree cottons do not yield so well as tobacco even under irrigation, nor can they replace *rozi* on account of their

more spreading habit and the necessity of water. The land is also full of white ants and therefore annuals will not grow well. So for these fertile lands, cotton that will not require watering and will give more than Rs. 1001- per acre is necessary, and such a kind is not obtainable.

Poor people having dry land grow *rozi* as it gives them some cash while from the same area they get all the food stuffs required for daily consumption.

(4) *Petlad and Sunare.*—The land of Petlad and Sunare is like the Nadiad *tobacco* soil and wherever there is well irrigation, tobacco is grown.

Rozi cotton is grown, here and there along with *bajri*, while only one field was seen of *Kahanmi* (Broach) mixed with *rozi* and *tur* at Sunare.

Here the people are very keen on tobacco cultivation and this crop is even grown in a portion of the dry lands. In the remainder, they prefer to grow *bajri* and *rozi* cotton together, rather than *Kahanmi* (Broach) cotton alone, as they thus obtain the grain required for their household use.

Cambay State.

(1) *Gudil.*—The land is either *goradu*, or clayey and black *goradu* soil is used for cotton while the black soil grows either wheat or cotton as the season allows.

The black soil has a subsoil of *goramti* and below that is the sand layer thirty feet from the surface. On this land cotton is grown only very rarely, the heavy rains giving no opportunity to sow the black soil.

The surrounding lands are saltish and are used for pasture, but only grow stunted and inferior grasses.

The cotton grown on the *goradu* land here is *Lahanmi* but has a short fibre like *lalio* of Bavla. Navsari cotton will, I think, grow here well. It is said, however, by the local cultivators that efforts have been made to grow Navsari cotton here but it did not yield properly. The cultivators being Garasias, take the bolls to their houses in order to remove the cotton, and thus save the cost of picking in the field a little. The shells of the bolls are used after boiling for feeding buffaloes.

(2) *Khakehar.*—The soil of Khakehar is both *goradu* and black.

Navsari seed from Navsari was distributed here some years ago, but the variety is not continued, people saying that the crop does not yield so well as *kahanmi*. Distance from the original locality may be the cause of the decrease of yield, but it is evidently a matter for study and experiment. The yield of the local *kahanmi* here is 400 pounds per acre. The land from Cambay to Gudil is almost salt, and beyond this point, the cultivation of cotton commences.

(3) *Cambay to Tarapur.*—This tract is a *goradu* tract in which *rozi* cotton is grown here and there. As at Borsad, tobacco is a very profitable crop in this soil, and there is, therefore, less chance of success for cotton either annual or perennial.

Panch Mahals.

(1) *Moralia to Rabiati.*—The tract from Moralia to Rabiati is mostly composed of medium black *goradu*, and *muramti* soil and cotton can be grown in these places though none is now grown. Gujarat cotton does not seem suitable to these places on account of the extreme cold and its effects on such late ripening varieties, but Khandesh cotton being early can be extended on a large scale.

The successful introduction of Khandesh cotton on the Dohad farm shows that seed can be freely distributed in this district in places where cotton is not at present grown.

(2) *Morali to Korat.*—The soil of this tract varies from medium black to light black with a little *goradu* in the neighbourhood of Korat. The tract will grow Khandesh cotton very well, but not the Gujarat varieties on account of the shallowness of the soils. The rock is not much more than one foot from the surface in any place. Furthermore the winter is very cold, and damages the crop when in the flowering condition. For the present no cotton is grown here at all, but wheat and gram are taken as *rabi* crops in deep soils, while the light soils are only used for *kharif* crops. These light soils are suitable for growing Khandesh cotton in place of the usual *kharif* crops.

(3) *Derol to Chapaner.*—From Derol, Halol is first reached where the land is slightly of the *goradu* type and more suitable for rice, *bajri*, *tur* &c. than for cotton, while frost here is likely to be as injurious as at Dohad. But round about Halol, the land changes and consists more of a black heavy type of soil while the Chapaner Hills protect the tract from sweeping cold winds. Cotton is, therefore cultivated here with success.

The crop yields here 400 to 500 lbs. per acre. The variety grown is *kahanmi* and the ginning percentage is 35 to 37 per cent. Broach Deshi of higher ginning percentage may suit here, while for the mountainous tract round about Chapaner, where at present there is only forest, Khandesh cotton can be grown which ripens early that is to say, before winter.

Where the cotton crop is grown here at all, it is almost taken annually as it pays well, and as a result no attention is given to rotation. Sometimes one row of *tur* to every four rows of cotton is grown while a mixture of cotton with *ambadi* is also very common. Here also, as in the Broach District, coarse rice is grown among cotton, but mostly broad-casted and not as in Broach in good rows.

As there is good water here, and the land of light colour, watering cotton like *Batla* will probably increase the yield two-fold.

(4) *Chapaner to Chapaner Road.*—The soil of this tract varies from light colour and texture to a deep black clay. The Halol tract is described above, while from Halol to Chapaner Road, there is cotton only half the way. The remaining four miles up to Chapaner Road are not cultivated and yield but grass. This tract, it is said, is submerged every year, but such places when reclaimed ought to yield very good cotton. Here, enterprise is required. From Halol to Chapaner Road, the land becomes blacker and blacker, and thus there will be less necessity of irrigation than in the tracts previously dealt with.

(*To be continued.*)

Notes on the Water Requirement of Crops.

BY

V. K. Tamhane, L. Ag.

IN hot and dry countries like our own where the rainfall is scanty, precarious and confined to a short period of less than four months, nothing is so important as to know the water requirement of crops. Manures play only a part of second importance to that of water, and it may be accepted as a truism that the crop obtained is more often determined by the water available than by lack of manure. The object of many of our tillage operations is the conservation of the moisture in the ground for the service of the crops. Indeed this forms the fundamental basis on which the whole practice of dry farming depends. It was therefore with the object of finding out what should be the least amount of water in a soil to make it fit for the growth of crops that I was given an opportunity of doing the following experiment. The results obtained were apparently abnormal and widely differed from those of many of the authorities on the subject. I have, however, no doubt of their accuracy, and the details of the experiment will presently be given.

In the *rabi* season when the effects of rain were almost over, a few samples of surface soil (black cotton soil) were taken from the cultivated land of the agricultural college farm, Poona, and the total amount of moisture determined in them. The average amount of moisture was found to be about twelve per cent. The land was sown with *shalu* (*rabi jowar*) and it was intended to find out the least amount of water necessary to be present in the soil for the proper germination of the *jowar* seeds. Accordingly a sufficient quantity of the soil was thoroughly dried and put in four pots of the same size. The quantity of soil put in each pot was equal in weight but the amount of water added to each pot was different. The soil in the first pot was moistened with five per cent of water, that in the second pot with ten per cent of water; the third pot contained soil moistened with fifteen per cent of water while twenty per cent of water was added to the soil in the fourth pot. An equal number of selected *jowar* seeds were then sown in each pot at equal distances at a depth of half an inch. Each pot was then kept under a bell jar and all communication with the outside air was cut off by pouring a little water into the vessel in which they stood so as to close the mouth of the bell jar. In this way unequal evaporation

of the water from the four pots was avoided. It was then expected that the seeds in the third and fourth pot would undoubtedly germinate since the soil in both the pots contained more than twelve per cent of water, the amount actually found in the cultivated land. The main object, however, was to ascertain whether the seeds in the first or at least in the second pot would germinate. If the seeds in the second pot had germinated, another experiment would have been started to find out what was the minimum amount of water between five and ten per cent necessary for the germination of the seeds, but the results of the experiment were curious, as not a single seed in any of the four pots germinated. I could not at first explain why the seeds did not germinate in the third and the fourth pot. I thought some serious mistake must have crept in and the experiment was repeated, this time with special care, but the results were the same and again not a single seed germinated in any of the four pots. Another series was then commenced using, however, this time twenty-five per cent of water in the first pot, thirty per cent in the second, thirty-five per cent in the third and in the fourth forty per cent. The results of this experiment were most satisfactory, all the seeds in all the four pots germinated with great vigour and energy.

All this goes to prove that the seeds in this case require at least twenty-five per cent of moisture in the soil. This seems apparently contrary to the actual state of things. The land was found to contain only twelve per cent of moisture and this was enough for the germination of the *jowar* seeds sown in the field. How is this anomaly to be explained? The explanation would not seem to be difficult. The total amount of water required for germination of the seeds may be more though at any particular time not more than twelve per cent can be found in the soil. The difference between twelve per cent and twenty-five per cent would be made up by the continual rise of the water in the soil from the lower layers, which contain a much larger quantity. If this explanation is correct, it would appear as is actually the case that while in deeper soils twelve per cent of moisture in the surface soil may be sufficient for the start and development of a crop like *jowar*, the same amount of water in very shallow soils would not suffice, and the seed would probably not germinate.

'Pan' Cultivation at Ramtek near Nagpur.

BY

V. G. Patwardhan, B. Ag.

DURING my visit to Ramtek last December, I found that *pan* cultivation there is rather different to that practised here, and perhaps a short account of it would prove interesting.

Pan is extensively cultivated at Ramtek a place twenty miles from Nagpur; also at Sawner, Badnera and other places in the same part of India. Ramtek is specially noted for its *pan* cultivation which is of very long standing and is very profitable to the cultivators who are locally known as 'Baris.'

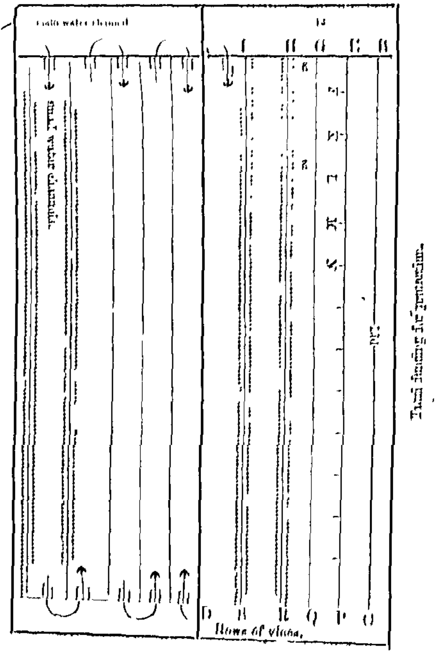
The soils that are generally selected are Medium black, Loam, *Murum*, *Besar* and *Barad*. The soil that is best suited for *pan* cultivation is light, porous, well drained and rather of a yellow colour. The black cotton soil is rejected owing to its sticky character and defective drainage. Solid murum is found at a depth of five feet. Mica schists are found abundantly round about. Any virgin land or an area fallowed for four years of the above character answers the purpose very well. In black cotton soil the cultivation does not thrive well. The roots rot, the yield is small and moreover, the *pan* obtained is of an inferior quality both in size and colour.

The fields are not usually ploughed or harrowed as a preliminary operation, to secure a good tilth. They are simply levelled. This levelling is a necessary operation in *pan* gardens. After levelling the land, the next chief operation is the erection of a mandap. Neither *pangara* (*Erythrina indica*) nor *shevri* (*Sesbania egyptiaca*) is grown as support for the vines nor plantains for shade, as is customary in the Western Deccan. Small split sticks of bamboo go above the mandap and are tied to it from the supports. The erection of the mandap is a very laborious and costly operation. The land is measured breadthwise and lengthwise and wooden pegs are fixed at a distance of two feet each way; and the rows are marked over the whole area. No bed system is practised and no cross rows are made. On the rows the strong wooden posts at a distance of ten to fifteen feet apart are fixed. This distance is known as a *kuntar* and the whole row lengthwise measures such fifteen to twenty *kuntars*, so that the length covered by one row is from one hundred and fifty to three hundred feet; and there are 240 to 300 such rows in one good *pan* garden. The distance between the rows is two feet. Six such rows make up one '*lamb*' (12 feet by 150 or 12 by 300 feet); so one *pan* garden known locally as '*tanda*' contains

forty to fifty *lambs*. The following sketch gives the details of a *tanda*. Two *lambs* are shown

A B C D is one *lamb*.

Distance E F is one *kuntar*. H I, H K &c., are double rows of vines; F, K, L, M, N &c., form the points where main posts of the *mandap* are fixed.



The mandap is made of strong bamboo with strong bamboo netting spread over it. This mandap is very durable and lasts from four to five years. It is six feet high. The mandap is covered by thin and even spreading of dry grass (specially *kusal* grass) to obtain shade. The whole *tanda* is protected from wind &c. by grass *tattis* eight feet in height on all sides.

When all these preliminary operations are over, regular tillage operations begin. The land is dug up by a pick-axe, clods are crushed and then it is levelled by means of a shovel in the rows. Before the rains, these operations are completed. At the end of July the planting of sets is done.

Planting of the vines.—The sets of vines are generally selected from the vines of old stock. There are three to five such cuttings or sets obtained from a single vine. The sets from weak and new vines are rejected. Every set is one and a half feet in length. Water is let into the field and then these sets are trampled down deep in the mud, each at a spans length on both sides of the row. Then they are earthed from the soil near at hand. The space between the rows from which the soil has been used for earthing up, forms the water channel. This earthing up prevents the sets being washed away or decaying from excess of water. Every set must have nine nods or eyes (locally known as *khada*) out of which five are buried in the ground and four are kept above the surface. Two leaves are kept on the exposed part of the planted set. For the first two or three days the newly planted sets are either watered by a sprinkler or by an earthen jar of egg-shape with a very small opening. After ten to fifteen days the sets begin to sprout. In black cotton soil the sets require twenty days to bear new leaves and roots. These must be protected from extremes of temperature; cold is warded off by spreading dry grass over them and the effect of heat is mitigated by frequent waterings. When the sprouts bear two leaves and grow twelve to eighteen inches high they are tied by *lavala* grass or *durbha* grass to very thin split sticks of bamboo, which form their supports. These are fixed in the ground and tied all their further end to the mandap. They are seven to eight feet in height. There are in all eight to ten shoots of vine tied to each stick.

Generally, well irrigation is prevalent. Tank irrigation is practised but to a very small extent. In winter, regular waterings are given at an interval of four to five days and in summer on every alternate day.

Manuring is generally given in the form of top dressings. The chief manures used are linseed cake mixture, castor cake, farm yard manure and seldom cocoanut cake. The cheapest and most useful is the linseed cake mixture. The actual proportion of this mixture is,

160 lbs. finely grounded linseed cake.
5 lbs. dried cocoanut pulp.
1 lb. pounded turmeric.
2 lbs. garlic.
2 lbs. ghee.
$\frac{1}{4}$ lb. asafœtida.

$170\frac{1}{4}$ lbs. total.

Sixty pounds of this mixture are required for one top dressing per *lamb*. There are in all six such dressings given in a year each at an interval of eight to ten days so that three hundred and sixty pounds of linseed cake mixture is required as manure per *lamb* per year. No other manure is given during the whole of the year.

The advantage derived from this mixture is, as they say, that the leaves improve in softness, fineness, colour and taste. It is supposed that farm yard manure requires a very good supply of water or otherwise the leaves get black stains. Fresh supplies of earth are also constantly required. After every two months the *pan* garden is earthed up with fresh earth.

Utaran or lowering of the creepers and transplanting.—When the creeper reaches the top of the mandap or a little above it, it is lowered down, the leaves are picked, and the vine is tied in the midst of the supporting stick with *lavala* grass. This is done three or four times in a year. It is a necessary operation, otherwise the shoots might be burnt by being exposed to the rays of the sun. In January *utaran* begins. The whole vine is untwined, all the leaves are picked up except some four or five leaves left at the top, which are known as *tobe*. The top portion of the vine about two feet long is kept above the surface of the ground tied by *padyal* to the supporting stick and all the rest is buried in the ground and earthed up as before. Fresh growth of the leaves is obtained just after the spring. *Utaran* is repeated every year.

A *tanda* lasts in good condition for five to six years. After this period the *tanda* is broken and the land has to be fallowed for four years

before it can be cultivated again. A good yield is obtained from the third year.

Picking of the leaf.—The next operation is the picking of the leaves. Every picking of a garden in full yield gives 16,000 to 32,000 leaves in one row according as the length of the row is 150 to 300 feet respectively. There are such five or six pickings obtained in a year. The leaves of different pickings are known by different names. The first and second pickings are known as *Kharwel* and *Katwar*. The third picking is known as *Junawan*. The new leaves that spring up after *utaran* are known as *Narali* leaves and *Lambori*. Out of these, *Junawan* are the best since they last well and bleach well.

The greatest care that should be taken in *pan* gardens is to keep the fields quite clean and to have regular waterings. The *tanda* must be kept thoroughly weeded, and no decaying material is allowed to remain inside the garden or in its vicinity, in order to prevent any spread of disease.

Disease and insect pests.—The chief fungus disease which affects the plantation is known as *Lohari*. It arises in the summer. It turns the leaves red. This disease is supposed to be stopped when cold water is sprinkled over the leaves. This is chiefly found in *pan* gardens which are irrigated by tank water.

The following are the insect pests :—*Ghandheli*, *Reta* and *Kapsi* and the bud caterpillar.

Ghandheli.—This is an injurious insect pest affecting the crop in winter. Its eggs are white in colour. These are laid on decaying vines and weeds and they hatch there. The caterpillars eat both the vine and the leaves and the effect is that the whole creeper begins to rot.

It becomes very difficult to stop the injury when the eggs are hatched. The remedy used is the application of lime as soon as eggs are seen on the creeper, and this is found to be very effective. Another treatment given is the keeping of a small bag of asafœtida in the current of irrigation water.

Reta.—It appears by the curling of the leaves from the top to the bottom and thus causes injury.

Kapsi.—In summer, the vines are affected by this pest. It consists of a mass of white insects which cling to the stem, leaves and buds and slowly the creeper is eaten up. The only effective remedy is to collect the insects and burn them.

Bud caterpillar.—This is a green caterpillar which eats up new shoots and buds and thus checks the growth of the creeper. No remedy is practised to prevent it When I visited the area I suggested that the affected portion be cut up and burnt. It was found that this has produced some effect in preventing its spread.

Approximate Cost of cultivation in general and the yield.—The *tanda* does not, as a rule, belong to one individual but it is always worked by the co-operation of fifteen to twenty members. The *mala* is too large for one of the local cultivators as the preliminary and other expenses of cultivation are too big to be incurred by one person. The preliminary operations are given generally by contract. These cover all the expenses of the erection of the mandap, wood, dry grass for tying, mulching &c., sets for seed, digging of land, forming of the rows and canals for irrigation &c. &c.

The following are the figures for one *lamb*.

Maximum rate per *lamb*	Rs.	100
Charges for preparing grass *tattis* for fencing	Rs.	50
Charges for two permanent coolies Rs. 6 per month each	Rs.	144
Charges for manure of linseed cake mixture.	Rs.	16
(Rs. 11 for 360 lbs. of cake and Rs. 5 for other things.)		
Irrigation charges per lamb for 8 months.	Rs.	10
Other charges including cess, marketing	Rs.	20
interest &c.	Rs.	20
Total charges...	Rs.	360

One '*lac*' of leaves contain approximately 16,000 similar to one *kudtan* of leaves in Poona. At every picking nearly one *lac* of leaves are obtained from one row 150 feet long. There are six such rows in one *lamb*. For the first year there are only three pickings obtained. So the produce of leaves for the first year is 18 *lacs*. Average price obtained per *lac* is fourteen rupees, and hence the total amount obtained is Rs. 252. Therefore the loss for the first year is Rs. 360 minus Rs. 252 or Rs. 108.

For the second year the produce is more and the expenses are less. Some Rs. 20 are required for the repairing of the mandap &c., but there are no charges for the first two items in the list given above. Hence

the cost of cultivation for the second year is Rs. 230. There are five pickings obtained this time. The leaves are good. The average rate obtained per *lac* is Rs. 15. So for thirty *lacs* of leaves the amount obtained is Rs. 450; deducting the expenses and the loss of the first year the actual profit remaining is Rs. 112.

From the third year onwards six good pickings can be obtained, so in all thirty-six *lacs* of good leaves. The average rate per lac is Rs. 16 and therefore the total amount obtained is Rs. 576. Deducting the expenses Rs. 230, the net profit obtained is Rs. 346 per *lamb*. This profit is maintained for the third, fourth and fifth years. At the end of the fifth year the total profit obtained is Rs. 346 × 3 + Rs. 112 = Rs. 1,150 per *lamb*. On the whole the business of the *pan* garden is very costly as well as very paying.

Varieties grown.—The varieties grown, are *Kapuri*, *Gangori*, *Bangala* and *Lawhad*.

The *kapuri* leaf is very thin, soft and of a very good taste. When the leaf is folded any way in the hand and let loose it regains its shape without being torn. The size of the fully developed leaf is about six by nine inches. It is the chief variety grown. As its name signifies, it smells very faintly of camphor. It bleaches well and easily. It can be eaten in large amounts without injury.

Gangori differs from *kapuri* in size and colour only. It is small in size and blackish in colour.

Bangala is another variety. The leaf is thick, greenish black and pungent. It does not bleach well. When eaten in large quantities the tongue becomes furred.

Lawhad is similar to *bangala* but is a little bit softer and superior.

A Note on Undi-oil.

BY

N. V. Kanitkar, B. Ag.,

Demonstrator in Chemistry.

UNDI-oil which is better known as "*Domba-oil*" is extracted from the seeds of the Undi tree (Calophyllum inophyllum). The seeds yield from fifty to sixty per cent of oil by weight. The trees are present in abundance in the Konkan in the Ratnagiri district, and are there found commonly growing on the sides of the roads. The oil is extracted by the country ghani and then exported to Bombay. Some is utilised locally for burning purposes and also for varnishing boats and other things. My attention was drawn to this oil by a private gentleman who wanted to know whether the oil can be utilised for any other industrial purpose.

A sample was therefore procured and examined for its different physical and chemical constants which are given below:—

Specific Gravity		0·932
Butyro Refractometer Reading at 40° C ...		69·500
Reichert-Meissl Number		2·220
Acid value		36·700
Equal to Oleic Acid per cent		18·350
Saponification value		192·000
Insoluble fatty acids		93·870
Iodine value		84·200
Lovibond's Colour-Tintometer Reading	Blue	0·400
	Yellow	6·000

The tintometer Reading shows that the material has a greenish appearance in thin layers. The oil has a peculiar smell which seems to be due to the volatile fatty acids present in the oil. These are present in considerable amount as is indicated by the Reichert Meissl Number. The acid character of the oil is shown by the high percentage of free acid. The Iodine value indicates that the oil belongs to *the group of semi drying oils* and hence its utilisation for the purpose of varnishing.

The high percentage of insoluble fatty acids would indicate the likelihood of its producing a good hard soap, and on actually preparing a soap from it a moderately hard fair lathering product was obtained.

The oil is said to have medicinal properties and hence is used as an application to the body in certain skin diseases. If these medicinal properties of this oil are not destroyed after turning it into a soap then the soap would have valuable properties from a medical point of view. This is a matter, however, for experiment. One more advantage the soap produced from the Undi-oil possesses is, that it makes a toilet soap of excellent appearance without the addition of any colouring matter whatever. The green coloured oil produces a beautiful yellowish coloured soap.

This oil is sold at present at Rs. 4/8/- per maund of twenty-eight pounds, which means about six pounds per Rupee.

Cultivation of Cocoanut in the Pernem and Mapuca Talukas of the Portuguese Territory of Goa.

BY

S. H. Prayag, B. Ag.

A very considerable portion of the cultivated area of the territory of Goa, consists of cocoanut gardens, with mangoes and jack fruit as subsidiary crops. Viewed from the hills of Panjim and surrounding villages, one sees a continuous line of cocoanuts and becomes impressed with the idea that the villages near the coast, are almost buried in cocoanut plantations. The line along the creeks, consists of a sandy soil, passing into red laterite soil with a large admixture of sand as we go inland until it becomes purely laterite soil just near the foot of the hills and on the hill sides. We can thus distinguish three more or less distinct zones where cocoanut cultivation is carried on *viz.* Pure sandy soil; Laterite mixed with sandy soil; Purely laterite soil. Besides these, cocoanut cultivation follows the rivers and streams in Parcem, Siolim and other villages of the Pernem and Mapuca talukas, the palms being found on soils that are on the banks of the sweet water rivers but which also receive salt water from the sea during high tides.

The largest part of the area under cocoanuts is found either on sandy-loam soil within a distance of ten to fifteen miles from the sea, excluding a belt one or two miles broad along the sea or creeks, or on laterite soil with a large admixture of sand in it. The palm thrives best in situations that receive sweet water from the rivers and also salt water from the sea during high tides. In such situations nuts can be obtained for a good number of years. It is less productive on sandy soils in the vicinity of the sea or of creeks and also on pure laterite soil on the hill sides.

Immediate contiguity to the sea or creek does not make for the success of the palms, as the trees become weak and stunted when the wide spreading roots come in contact with the creek water. The cultivators recognise this fact and they generally grow them in the situation mentioned above. The climate of this part of the country is hot and moist, and as a steamy climate is most congenial to the well being of cocoanuts it will be evident that Goa fulfils its climatic requirements perfectly.

Planting.—For planting, nuts that are perfectly matured, well-formed, and selected from trees of good bearing habits, are used. They are brought down from the trees by a man. The falls from the trees are rejected, as the fall frequently cracks the inner shell, without giving any external evidence of injury. The nuts are sown in seed beds that are ready for them, in the month of September, generally at a distance of two to three inches apart. When the plumule has fairly thrust its way and when the sprouts are six to nine inches high, they are taken to be in the best possible condition for permanent planting. This takes six months if the nuts are good and the seed bed too a good one; but generally it takes eight to nine months before they are ready for transplanting. In April, pits two to three cubic feet in size are dug, and in these the seedlings are transplanted, at a distance of ten to twelve feet. Wider planting is not generally practised. The planting is done either at the end of April or in the early part of May, and each plant is watered daily till the rains set in. If the soil is laterite, the following material is put in each pit, before planting the seedling:—Sand at the bottom for good and efficient drainage; over it, leaf mould, ash, sheep droppings or cowdung as may be available thoroughly mixed with original soil. Till the fourth or fifth year no more manure is given. I have been told that the regular application of manure except

a basketful of ordinary salt is scarcely followed and that excellent crops are borne for successive years. The people however recognise that if the manuring is not done for a good number of years, even in fertile soils, the trees that produced a hundred select nuts a year at one time yield in succeeding years only uncertain crops of small and inferior fruits. In Parcem, fish manuring is adopted. The fish known as "Tarli" is used at the rate of a basket per tree, in the month of September when it is plentiful; it is put at a distance of one foot from the trunk of the tree and is thoroughly incorporated with the soil. This manure is especially used in sandy soils. In laterite soils rich cultivators put the following manure at the end of May, or in June:—

Ash	16 lbs.
Sand	10 basketfuls.
Sheep droppings	16 to 20 lbs.

This manure is used once in three years. It is sometimes also used in sandy soils for small trees. The cocoanut easily responds to manure and bears luxuriantly if the manuring is properly done. The application of salt has been said to have a beneficial effect upon the productive capacity of the tree.

Enemies.—Rats are a source of considerable loss but they are not found on an epidemic scale. Among serious insect pests, is the rhinoceros beetle which is said to appear occasionally and cause the death of many trees. The attacks are confined to the growing point and as far downwards as the wood is tender and susceptible to the action of its powerful mandibles. Two or three grubs of these beetles, if undisturbed, are able in time to completely stop the growth of the tree and ultimately lead to its death. The beetle or its grub is searched for by drilling holes in the stems of the trees; it is taken out by a hooked wire and is killed. This remedy is no doubt effective, but it is not possible to carry it out if the channel made by the borer is very deep, unless the hole made in the stem passes through the other end of the stem and is then examined.

Summary.—(1) Besides the mango, there seems to be no other fruit tree that may be grown to a greater extent in Goa than the cocoanut. Here a good crop of cocoanuts may be guaranteed if the trees are planted in a suitable situation. The growing of cocoanuts is a very remunerative and most reliable industry and one that has been receiving greater attention of the people recently than in former days.

(2) The natural enemies and diseases of the plant are relatively few and are easily held in check by the cultivators.

(3) Wider planting than what is now followed in some parts is most desirable, as thereby exposure to the sun and air will be ensured and the trees would make a wider expanse of crown.

(4) In view of the ever expanding demand for cocoanut products, the industry presents great attractions to palm growers and the cultivation is likely to be taken up on a scale of greater magnitude than hitherto, in the near future.

A Reminiscence.

BY

G. S. Kurpad, B. A.

IT was a bright morning. There had been a light shower the previous evening and the breeze was cool. The sun was slowly rising and I was tempted to take a walk after I had my coffee. I went for some distance along the road which ran in front of the bungalow at which I put up, and then turned into a field on the roadside. I soon reached a small canal in which water was flowing. It lay right across my path, and not wishing to turn back, I stepped back a few paces, took a run and cleared the canal. On the other side the fields were not cultivated. It was the pasture land of the village. I collected a few stones which seemed interesting and some curious looking plants. I proceeded further and came to a small tank which was half-filled with water from the rain of the previous evening. The frogs made a deafening noise and the air was full of those winged insects which are so plentiful after a rain. Some birds were busy catching these insects and filled the air with the peculiar cry which they give on such occasions. I stayed on the bund for about five minutes and it was with great reluctance that I passed on. By this time I had lost my bearings and was only intent upon finding my way back home.

I saw a group of trees ahead and wended my way towards it. On the other side of this grove I saw a man ploughing his land and as I saw the depth of the furrow made by the plough, I thought of the ste el ploughs that I had handled when I was quite a boy. I enquired of the farmer what he thought of his land. He entertained a good opinion of it and told me that with timely rains he could keep himself and his family in ease. I then asked him if he had seen the steel plough. He said he had heard of it; but did not think much of it. 'They say that it wants two pairs of good bulls to draw that plough, sir' he said 'and I cannot afford to buy and keep two pairs of bulls. especially when I can get on with these two bulls and this plough, I am an old man and have not got faith in these new ideas. These old things are good enough for me,' and he urged his team to move on. I took my dismissal silently and walked away.

I struck a path in a field close by and walked in the direction in which I thought the bungalow lay. I came upon two men lifting water from a well. A long beam worked on a pivot between two upright pillars. To the longer arm of this beam was attached a thin long bamboo at the lower end of which was a bucket. One man stood on two stones projecting over the edge of the well letting the bucket down and bringing up the water. The other man balanced himself on the big beam near the pivot and moved this way or that, thus helping the first one as required with his weight. I had not the heart to ask them anything or suggest anything after my talk with the farmer,—and returned home.

Some Economic Water Plants of the Bombay Presidency.

BY

H. M. Chibber, M. A.

UNDER the title of water plants are included plants that grow in water or in the saturated soil that fringes a tank. Some of them are specially raised by men, while others grow wild. Many o them are not sufficiently known, and all of them have only a local importance so far as this Presidency is concerned. If however better attention were paid to them some of them would undoubtedly repay the labour. The one of the greatest promise is

Trapa bispinosa Roxb.—Dr. T. Cooke in his "Flora of the Bombay Presidency" remarks as follows regarding this plant. Vol. I, p. 518. "In tanks throughout the Presidency, often cultivated; very abundant in tanks in Gujerat. The fruit is eaten by the natives, and is much esteemed. It is known to Anglo-Indians as the water-chestnut. Distribution throughout India, Ceylon, Malaya, Tropical Africa—vernacular name *Shingada*." Related species are found in other parts of the world. One called *Trapa natans L.* grows in Kashmir, Persia and central Europe.* The best variety of this species locally known as the *Basmati* type was introduced from Kashmir by me last year. It did well at the Vir Water works in the Poona District. One or two characters of this variety may be stated here. It takes only three months or so in this part of the country to run its course from germination to formation of fruit and seed, while the local species takes nearly double the time. In taste it is superior to the local form, but in size it is smaller. It is possible that it may not all the same be inferior in yield or productiveness. This point is yet to be settled.

Uses.—Fresh *Shingadas* are taken by men after boiling. They are boiled with the shell. A little of iron sulphate is added to the water for boiling. The iron salt combines with tannin in the shell which thereby turns dark. The nuts on cooling are cut open like a gaping

* Hooker's Flora of British India, Vol. II, p. 590.

oyster shell. They are sold by hawkers in this condition. The object of using iron sulphate seems to be to add to the attractiveness of th nuts, as the milk-white kernels form a sharp contrast with the jet black shell. The nuts are also used *in a dry state*. They yield white flour which is used in the manufacture of sweets of all varieties. Shelled dry nuts are sold all over the Presidency by native druggists called *gandhis*. They are brought for sale from outside this province, as all the local product is consumed in the fresh state. After a plantation has yielded a crop of nuts the old leaves rot in water. If the water of a *Shingada* tank is required for drinking purposes, the leafy parts should be removed after fruiting is over. In parts of Europe (France) the leaves are fed to cattle in the form of silo. *Shingada* cultivation is also practised in China. Some particulars regarding cultivation in the Thana District of this nut are embodied in another article in this number by my friend Mr. T. R. Kotwal, B. A. LL. B. *

Nelumbium speciosum Willd. Nymphæa Lotus L. and *Nymphæa stellata Willd.*—These constitute the Lotus or *Kamal*, with large gay flowers of different colours. They bear in fact the largest flowers to be seen in this Presidency. They all grow within tanks and form large circular shields of leaves. In the first one the shields are elevated above the water surface when fully formed, while in the last two they remain closely applied to water. They propagate by seeds as well as by tubers. The seeds of the former are large, being the size of a groundnut seed. The latter have small seeds like mustard. The embryo of the former is embedded in the interior of copious albumen which is hard as stone when dry. (The embryo forms an object of great scientific interest inasmuch as it develops green colour (chlorophyll) while cut off from any light inside the albumen and seed coats, which is quite unusual). The tubers of these plants are also different. In the former one, it is elongated and perforated by about a dozen straight air channels. In the latter it is compact and oval or ball like with a very thick hairy outer shell-like coat. In the former the flesh is white; in the latter it is yellow.

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* The Sub-Engineer of Kharicut Canal Ahmedabad District informs me that the outturn is from 40 to 80 kacha maunds per acre (fresh state) which sells from a rupee to a rupee and a quarter per maund. In the dried state the product weighs a fourth of it, and the price then is four times as much. (Letter No. 101 of 18th January 1912).

Uses.—The flowers may be considered first. These are useful in a number of ways. *Æsthetic appreciation of their beauty and fragrance* on the part of the people gives them a very *high place in Hindoo* mythology. They are much sought after for the same reason by Hindoo devotees. The fragrance or flavour of the petals render them useful *for the making of sherbat or* sweet cooling beverages. Regarding the seeds the albumen alone in the *former is edible, since the green* embryo or germ is decidedly bitter. The edible part is turned into flour before it is utilised. It is regarded as highly nutritious and credited with tonic properties. It enters into the composition of tonic *foods peculiar to the natives of India which are known as Pals.* The following analysis of water-free substance of the seeds of *Nelumbium* (*Kamal Kakdi*) and of *Trapa* (*Shingada*) is of interest. It is taken *from Bulletin No. 68 (1899) of the* United States Department of Agriculture, Office of Experiment Stations, Washington, bearing the title "Some Chinese *Vegetable Food Materials*".

Water-free substance of the seeds of	Proteins.	Albuminoids.	Amides (by difference).	Fat.	Starch.	Cane sugar.	Reducing sugars.	Crude fibre.	Ash.	Undetermined.
Nelumbium speciosum (Kamal kakdi)	18.23	16.95	1.28	2.67	56.57	4.19	2.64	3.15	3.32	8.63
Trapa bispinosa (Shingada)	12.15	11.65	0.51	0.73	67.63	.	1.42	1.58	2.67	10.70

As regards the tubers those of the Nymphæa are much sought after and relished. When young, they are oval and about the size of a lemon. These are known in Gujerat as *Bolanda.* The larger ones which represent growth of several years are called *Gangad.* They are either boiled *or roasted. They taste somewhat like the chestnut with a peculiar* and agreeable flavour.

Propagation.—Some tubers that may have been left over, sprout with the beginning of the rains in June. The villagers *often collect and preserve some seeds which form in winter,* and drop these in the water that collects in the tank, hitherto dry, with the first rains. No further attention is paid to the plants.

Scirpus Kysoor Roxb.—This is one of the sedges. It produces globose tubers of a white or dark colour clothed with matted fibres. It generally occupies the fringe of a tank. It is restricted to the Konkan. Its local name is *Kasra.* The tubers which have the *size of a small*

potato are sweet and nourishing. The flesh is white as in the apple, and quite firm. They are to be had about November and December. Their supply is extremely limited. It may be taken raw. If boiled in a large quantity of water it looses its sugar and consequently its sweet taste. Below is given an analysis of a related plant which together with the local one is grown all over China. It is taken from the same bulletin as the previous one.

Analysis of water-free substance of the tuber of	Proteins	Albuminoids	Amides (by difference)	Fat.	Starch.	Cane sugar.	Reducing sugars	Crude fibre.	Ash	Undetermined
Eleocharis tuberosa	5 91	4 54	1 37	1 23	36 58	27 23	11 78	5 53	5 32	6 42

(To be continued.)

A Note on Agriculture in the Kotah State.

BY

Ghanshiam Das Gupta

THE Kotah State lies in the centre of the large geological area usually classed as the Upper Vindhyan composed of old Palæozoic rocks. Their composition is very uniform.

Although chiefly composed of sandstones, a type of rock which often contains much coarse detritus, the fineness of the rock throughout this entire formation is remarkable.

The agriculture here is very undeveloped. A simple wooden plough, a very primitive harrow and a few other implements exhaust the list of the tools of husbandry in use in almost the whole of Rajputana. The plough used in the Kotah State may be compared with the light ploughs of Gujerat. The soil being sandy and easy to work, a pair of bullocks can do fairly good work with it. The harrow is almost similar to that in use in the Deccan with a few minor differences in construction.

Sowing is generally done by hand, and it is wonderful what uniformity can be reached by this method. For small seeds, however, a special device is used. A funnel shaped hollow bamboo rod nearly four

feet in length is taken. The mouth is covered with leather outside and in, and the whole is tied loosely to the plough, and so arranged that the seed falling from the cultivator's hands through it, drops in the furrow prepared by the plough, thus sowing one row at a time.

Intertillage operations are done with the same plough. Of course it can be easily drawn through the rows, and removes shallow rooted weeds and stirs the surface soil to some extent.

To those who constantly hear so much about the extended researches and notes on manuring it would sound curious when I say that no manure whatever is given to the fields. When, after a time, land refuses to yield crops, they leave it quite fallow for many years. This they can afford to do since extensive fields are always available on easy terms, owing to a sad want of enterprising and hard working cultivators. If fallowing, unfortunately, does not give sufficient tone to the debilitated land and bring it to its former condition the land is abandoned as barren.

The system of rotation and mixed crops is practised in a crude form, the principal crops being wheat, *jowar*, *bajri*, inferior rice, maize etc.

The most important and profitable cultivation is "opium," in the whole of the Malwa district comprising a portion of Rajputana and the Central India Agency. This industry is likely to get a death blow by the recent laws prohibiting opium in China, to which country a tremendous quantity has hitherto been annually exported.

The general condition of the ryot is very deplorable. He is quite ignorant, and deeply conservative and, I regret to say it, profoundly lazy. These facts in brief show in what stage of development Rajputana is as a whole, from the agricultural stand point. However, we are sure no body of men, even if they would, can stand still in the great race of progress going on all over the globe. We are quite hopeful of the future and believe that an ever improving condition of things is sure to result from the stride towards advancement at which our countrymen are aiming. Again the history of others that have trodden the path before us, infuses courage in us to advance without fear. It fills us with hopes of ultimate success and urges us to work with full trust and belief in the Great Power, that rules all destinies. I cannot but conclude by quoting a very common proverb in the whole of North India.

"Agriculture is the best and noblest of professions."

Observations on the Ceylon Papaya in Poona.

BY

L. B. Kulkarni, L. Ag,

Ganeshkhind Botanical Gardens.

IN May 1909, seeds of the Ceylon papaya of reputed excellence were received from the Superintendent, Botanical Gardens, Peradeniya. They were sown in pots in an ordinary way on the 3rd of June. The pots were kept under shade and watered daily. On the 12th, seedlings began to appear; by the end of the month, almost all the seedlings were above the ground.

After a fortnight, the pots were gradually exposed and then after a week, the seedlings were transplanted, when they were about six to eight inches high, to the permanent field. No distinction could be made, while in pots, between the seedlings of the local types and those from the Ceylon seed. The field in which they were planted runs from east to west with a slope from south to north. The soil is medium black about three feet deep.

The seedlings were transplanted on the 22nd of July between the custard apples already in the plot, eight feet apart on all sides. No manure was given. Regular watering was given from November at intervals of ten days. Growth on the whole was vigorous. Some special characteristics began to appear as the plants grew older—the first thing noticed being the longer internodes than are found in the local variety. The second characteristic was the thin and short petiole. The plants at the lower end of the plot where water was apt to lodge, first grew vigorously and then seemed to get a check and gradually died. Those at the upper end where water was scarce, grew slowly and flowered late. Those in the middle had good vegetative growth and flowering capacity.

Flowers appeared on the trees in the middle of the plot after ten months from sowing, while those at the upper end after fifteen months. Plants in the middle were about nine feet high when in flower, while those at the upper end were only six feet high and looked pale with leaves of a yellow colour.

Chillies of a local variety were planted between the papaya plants during the monsoon. They grew luxuriantly but bore little fruit. In December, potatoes from the market were grown after the chillies had been removed in September. They were manured with farm-yard manure (about two cartloads to the guntha). The outturn was about 5600 lbs. per acre (calculating as one hundred and forty pounds per guntha which was the area occupied by potato). The tubers were quite healthy.

In all, one hundred and seventy-five seedlings were transplanted ; of these, nine died after transplantation. Of the remaining plants, the distribution of sexes was as follows :—

Female	Hermaphrodite	Male
95	29	46

Again, one hundred seedlings were transplanted, in another field, between oranges. Here the plants grew more vigorously. The leaves were dark green and the flowers appeared after nine months. The proportions of the sexes here stood thus :—

Female	Hermaphrodite	Male
38	7	54 (one died).

It will be noted from the above figures that the proportion of the sexes is very different in the two cases. The only difference between the two plots, besides the defect in the level of the ground of the first already mentioned, was that the former was exposed on the north and west, while the latter was protected from the winds by the mango and other road side trees. The plants in the former were gradually destroyed line after line by the severe cold winds from the west. This fact was quite clear when the plants in the front line were found bending towards the east. Then gradually one line after another was completely destroyed.

Inflorescence.—The only differences found in this, are as follows:— The peduncle in the male is shorter and thinner in the Ceylon papaya than in the local variety. Female flowers also are smaller in the Ceylon papaya than in the local variety.

Fruit.—The most common shape of the fruits is oblong-oval. The average number of fruits per plant available for the market is sixty up to the time when the plant is two years old. Each fruit weighed from

one to five pounds. The average may be taken at three pounds. Again, each fruit on an average measured eight by six inches. The maximum size was twelve by ten inches, with yellow patches here and there when approaching ripeness.

The pulp varies in thickness from 1 to $1\frac{1}{2}$ inches and is of an orange colour. Plenty of seeds are generally found at the top. The fruit is much more piquant in taste than that of the local varieties. In taste it is luscious but not too sweet; its flavour is moderate and pleasant. It has the consistency of a well boiled potato with considerably more water.

Seeds.—These vary from a few to hundred of them in a fruit. They are smaller than those in local fruits. They are quite black when fully developed and one tola weight contains 500 to 550 when dry, and 300 to 350 when wet; while the country ones contain 400 to 450 when wet and 150 to 225 when dry.

Mr. MacMillan in his report on papaya, says that fruits are generally obtained after eight to ten months from the time of sowing. The size of the fruit varies from eight to fourteen inches, while the weight runs between five and eight pounds. The taste, he says, is usually pleasant and the average number of seeds per tola when dry is 500 and when fresh, 102.

Mr. DeCruz, of Bombay in a private letter to me reports as follows about the Ceylon papaya:—He planted the seedlings ten feet apart in land meant for roses and manured with bone meal; fruits were obtained ten months after sowing and they were remarkably long in size and of quite an attractive appearance and of a very sweet taste.

Notes on Agricultural Conditions in the Bijapur District.

BY

Mr. B. S. Chenegiri.

IN the following article I have put together a few notes on the conditions which prevail in the district to which I belong, and which has the reputation of being one of the most famine stricken in the Bombay Presidency, if not in India.

As a whole the district cannot be called hilly, though in the southern portion there are two ranges of small hills, chiefly running through the Badami and Bagalkot talukas. The remainder of the surface is chiefly a large rolling plateau. Forests, in the sense of large areas of tree growth, do not exist to any extent. *Babul* trees are found all over the district, and there are many areas of sparsely growing trees, which are technically speaking forest, but this is all. The average annual rainfall is low, and, more than that, is extremely variable,—which may be due, in part, to the bareness of the country and the absence of forests.

The soil of the district is also very variable, but by far the larger part consists of black cotton soil in one of its many forms. In the south, however, there is a great change and there are large areas of sand or sandy loam. The black soil has the characteristics of this type,—becoming very stocky when wetted,—hungry for water and requiring much water in order to make it wet, and retaining moisture very well when once thoroughly soaked.

The climate is hot and dry. During the hot weather months—April, May and June,—the temperature commonly rises to 110°F. This in a district containing little shade, and little water, makes travelling difficult at that time of the year. The difficulty of water supply is felt in every part of the district, except on the banks of one or two of the great rivers crossing the country from East to West. As a result, the villages are far from one another, and their position is regulated, to a large extent, by the existence of wells or other means of obtaining water. It is rare in many parts to find more than one or two wells to a village,—these being public ones. It is frequent too

that this supply fails in the hot weather, and in this case, the villages have commonly to walk five or six miles for water at this season. Irrigation is, hence, not largely used, except in a few favoured corners of the district where good wells are found. As a result, too, the condition of the cattle over much of the area is very precarious. The amount of grass available on the waste lands in the rainy season is very small,—and in many parts they are fed all through the year on dry *jowar* or *bajri* fodder. It is not surprising that little care is taken in the breeding of cattle.

There are four big rivers in this district, the Krishna, the Bhima, the Malprabha and the Ghatprabha, and a large salt water stream, the Don. The lands on the banks of these rivers are annually covered by the full flood in the month of August and the lands so covered are rich and fertile. The areas on the banks of the Krishna, produce first class crops notably of maize and brinjals. Flat beds where water is available throughout the year are particularly selected for this cultivation.* The soil on the Bhima being a sandy one, affords a good scope for *Karbooj* (*Citrullus Vulgaris*) cultivation. A good variety of *rabi* jowar is grown here annually in the *rabi* season.

On the banks of the Don stream, an excellent variety of wheat is grown. The water of the stream, though now far too salt for irrigation is not too saline for drinking by those who are accustomed to it, and the people are in the habit of consuming it even without boiling.

Up to the present there has been little introduction of crops from outside. The native cotton of short staple, is largely grown in the month of August especially in the talukas of Bijapur and Bagalkot, in each of which there is a central cotton market. In other talukas, cotton is sent to the above two centres for disposal, and the profit expected by the people is very small on account of the large expense in getting the cotton to the market. On the whole, the cotton crop in this district may be looked upon as secondary. The chief cultivation is, of course, *jowar*, grown both in the *kharif* and *rabi* seasons. The most important *kharif* crops are as follows :—

Jowar, *bajri*, *tur* (pigeon pea), green gram, *sann* (hemp), and sesamum (*til*).

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* See Poona Agricultural College Magazine, Vol. III, No 2.

Jowar is nearly always sown here mixed with one of the above crops, except *bajri*.

The most important of the *rabi* crops are as follows :—

Jowar, cotton, wheat, gram, safflower, linseed, and nigerseed. *Rabi jowar* is sometimes sown together with linseed or nigerseed. Wheat is sown together with gram or safflower. Before sowing cotton, cotton seeds are dipped in water and rubbed against the bottom of a basket placed in an inverted position. This practice is generally carried on by the women.

A certain amount of rotation is practised in some parts of the district, as for instance, the sowing of *rabi jowar* one year in place of *kharif jowar* or pulse in place of cotton on the same plot, but there is little systematic observance of the principle.

The chief garden crops are as follows :—

Chillies, onions, carrots, *brinjals*, and sweet potatoes. These five crops are common to all places of the district. On the whole the garden cultivation is not good, manures are little used and cattle manure is badly preserved, watering is irregular, the garden land is weedy and so on. There are some places, however where garden cultivation is well done,—some villages in the neighbourhood of Bagalkot being an example. There is only a small amount of the more difficult and intensive garden cultures like that of sugar-cane, plantains, betel-vine, and mangoes, and the methods of carrying it out vary much in different parts of the district. The principal centres are as follows:—Betel-vine is chiefly cultivated in the Bagewadi and Badami talukas, mangoes in Badami, sugar-cane in Sindge and Badami, in the latter to only a small extent, while plantains are grown all over where there is sufficient water.

College News and Notes.

THE long spell of holidays after the University examinations in March gave an air of profound stillness to the College surroundings, save for the brisk and constant stroke of the mason's hammer busily shaping the stones, and the continued grating of the carpenter's saw modelling the timber for the hostel. To the student, however, this would prove little diversion, particularly if he was one who had foreseen he had no chance of being an inmate of the hostel. He is, we believe, never in his element as when he is among his fellow students; and we must honestly confess that to many of us who happened to spend the vacation or a portion of it in the station, the *reunion* of June 4th was a matter of deep interest and eager expectation. And we daresay the meeting was a most cordial one, for nothing binds friends faster than their getting together after a prolonged separation.

Many of our comrades—the seniors of the last year—have left us, being ready to go and work for the good of their country. We miss them, no doubt, though it would be selfish for us to claim their companionship in the lecture-rooms for another year. We are glad of their success that they are now graduates and are wearing the toga, solemnly conferred on them, of a profession that in India stands most in need of advancement at the hands of zealous patrons. The way before them now is truly long and a difficult one. We cannot but wish them all smooth sailing through the ocean of embarrassments that may be awaiting them. In all things, this is our sincerest wish for them that they ever prove true to the college, which has done its best to instil into them the noblest qualities of heart and intellect.

And to our new made friends, we give our warmest welcome, and desire that they may have a happy term of scholarship at the College. We hope also to see them enthusiasts in all affairs pertaining the progress of the institution whose good name has kindled in us a dear love for it and has attracted them all from far and near to it.

The students who have graduated number twenty-two and we feel pleased to give their names below. The newcomers for the regular course are forty-two. Though the majority of them consists of Hindus we are glad to see that there are several Christians and Parsees and

Mohamedans adding to the present number. The four Government scholars from Ceylon who were expected have arrived and there is another one too from Jaffna, who accompanied them to take up the agricultural course. We are proud to claim even a student from Burma who has been specially deputed for training in Agricultural Botany and Chemistry.

The short-course class is also yearly gaining in repute, there being seventeen students on its lists.

The gradual influx of students year after year speaks well for the teaching obtained at the College. The practice of agriculture and the dignity of labour, nowhere, we are of opinion, could either be learnt or appreciated better. We can hope therefore with increasing years to see it extend more in prosperity and renown.

To turn to college discipline, we must admit that our course is largely a sort of feudal vassal to nature and as such subject to her temperaments. Last year she looked ill upon us and, much to our grief, we feel she is even more incensed this year. This her disposition very severly crosses the path of our field work and experiments; but what is more, portends hard days for our country. The college farm is—to put it frankly—beautifully laid out according to the final and permanent cropping scheme that has recently been drawn. But it sadly misses the greenery which might have given it and the workers at it a pleasanter look. Even now, though it is almost the middle of July and ought to bear a look of animation, it stands bare. It makes the farmer heave a sigh of pity to see the land wistfully longing for the seed to do a good turn for all the toil the labourer with the best of implements has put on it.

The weather conditions do seem most strange this year. Notwithstanding the indications of an approaching monsoon we believe, it is most difficult for any one to say why the clouds have not and do not condense here. The outlook seems grave and we can only rely, with humble patience, on Providence to spare us from the throes of a famine which appears so ominous.

According to the new cropping scheme the major portion of the farm has been divided from east to west into twenty-six acre plots each acre being sub-divided into four 10—*guntha* plots. This area is for the purpose of experiments by the B. Ag. students. The S. Ag. men have a separate area consisting of 4—*guntha* plots for each. The F. Ags.

have also a special piece of land for their use in the practice of all the farm implements. This scheme greatly remedies the difficulties hitherto experienced of planing a regular system of rotation or of conducting experiments with great accuracy. The permanent paths between the various plots and their sub-divisions will now enable our visitors to make a pleasant survey over the farm to witness the fruit of the students' own toil We regret, however, that the B. Ag. students who had to work at *kharif* crops like *jowar*, cotton etc. have up to now only the few items of the operations preliminary to sowing on their cultivation sheets, and their diaries only note their expectancy of rain. The S Ag. students had sown their cotton on the in anticipation of very good rain which the favourable signs at the time indicated. But theirs has probably been a fruitless venture. At any rate every little experience on the farm is meant to be kept by—like the provident ant—for use when need comes.

There have occurred a few changes in the college staff since the holidays. Mr. Butani, Assistant Professor of Physics and Mathematics, has returned to Sind, his place being taken up by Mr. S. S. Godbole, L. C. E. Mr. Butani during his stay had very much endeared himself to the students by his willing sympathy He had ever a kind word for all. He is now lecturing in chemistry and physics at the Sind College where we wish him the best of success and a wide scope for his high attainments. We are sure that Mr. Godbole will soon be equally popular with us all.

Mr. C. V. Sane, Assistant Superintendent on the College farm has gone back to Baroda to serve in the Gaikwar's State. Mr. Sane had a brilliant career at the College having graduated in the first class. It was through his zeal that the Agricultural Association and Debating Society got its start; and as its first secretary he worked for it with the deepest concern. As demonstrator on the farm, he was always willing to help the students in their difficulties. We trust that bright prospects and a career, as bright as his collegiate one, will stand out before him in the Baroda State. We hope too that as an "old boy" he will always have an affectionate corner in his heart for the Agricultural College which has sent him forth with a proud handle to his name. Mr. B. S. Patel who topped the list of graduates in the last examination is the present Assistant Superintendent of the farm. Mr. Patel too, has been a very successful student passing

highest in all the three years of his course. He well deserves the post to which he has succeeded and we have every reason to congratulate him.

Mr. G. D. Mehta who was in charge of the Seed-Testing Department has been transferred to the Central Provinces as Supernumerary Agriculturist under the Director of Agriculture C. P. The Seed-Testing Department has been handed over to the care of the Economic Botanist.

Mr. Chibber who was acting Economic Botanist during the absence on leave of Mr Burns gave over charge on the 30th June when Mr. Burns returned We trust Mr. Burns has profited by the change to the air of his own native highlands and we should feel glad to have from him ere long some personal reminiscences of his picturesque country.

Mr. D. D Sanga, our Veterinary Professor, has taken a year's furlough and Mr. F. Gracias, G. B. V. C. is acting for him. He is now in charge of the Public Veterinary Hospital and also of the B. Ag. Class in Veterinary Science. Mr. B. B. Joshi, G. B. V. C. has been appointed resident officer of the hospital and he also lectures in Veterinary Science to the S. Ag. Class.

We first of all miss Mr. Sanga as he was so extremely popular. We are right glad of Mr. Gracias' deserving promotion and trust he will soon come to hold his office permanently. We welcome Mr. Joshi very cordially and feel assured by his amiable disposition that he will be much liked by the students.

Of the past students, we are pleased to note the appointment of Mr. P. G. Dharwarkar, B. Ag. (1911) as Agricultural Teacher in the Government High School, Kanouj. We also wish success to Mr. M. Gokulbai Desai, B. Ag. (1910) who has been sent to England by the Gaikwar's Government to get a special training in Gardening.

And we are glad to mention that Mr. V. K. Kogekar, L. Ag. (1905), recently in charge of the Dry Farming Experiments at Ahmednagar, has been appointed organizer for the Deccan Agricultural Association since February last. We congratulate Mr. Kogekar on his new appointment and have no doubt that his past experience in the service of the Agricultural Department will stand him in good

stead in achieving distinction in the useful vocation that has opened out to him. He has been working zealously, since his appointment, in carrying improved methods of agriculture to places far removed from cities and Government Agricultural stations and his work is already being well appreciated both by cultivators and high Government officials.

The graduates in Agriculture for the year 1912, of whom twenty-one received their degree in Bombay on July 2nd are :—

Mr. B. R. Bhadkamkar.	Mr. B. B. Joshi.
,, M. M. Desai.	,, D. K. Kale.
,, R. K. Desai.	,, N. J. Kangle.
,, K. R. Gadgoli	,, R. D. Khandekar
,, M. R. Gokarn.	,, J. S. Kulkarni.
,, V. N. Gokhale.	,, C. R. Mugali.
,, J. T. Gonsalves.	,, S. P. Nazare.
,, V. S. Habbu.	,, A. R. Neginhal.
,, K. V. Paradkar.	,, R. G. Padhye.
,, B S. Patel	,, S. K. Sane.
,, N. V. Hanmante.	,, S. P. Sen.

Mr. N. C Das was the only candidate for the Diploma in Agriculture which he has secured by acquitting himself very creditably in the special examination held for the same at the College.

The University results in the S. Ag. Examination were very good, their being only two failures among eighteen students. Mr. S. R. Inamdar stood first. Mr. S. K. Mahableshwarkar who ranked highest after the scholars holds the monitorship for the present year. The new hostel not being yet ready, the monitor has still the difficulties of his predecessors in attending to the needs and comforts and reporting on the discipline of the different clubs, which are still dispersed.

We are sorry to record eleven failures in the F. Ag. Examination. A higher standard required of the students taking up the course has much to account for it and we wish the students will in future succeed better by working up to the standard.

Several of our new graduates have already had the good luck of being enrolled in service, Mr. M. M. Desai under the Deputy

Director of Agriculture, Mr. Habbu on the Alibag Farm, Mr. Hanmante at the Poona Civil Dairy, Messrs. Gokhale and Padhye on the Manjri Farm and Mr Neginhal on the Dharwar Farm.

We are pleased to see that the present fieldman on the College farm is Mr. Vaidya who was the best student of the short course class of the year

The College Gymkhana.

The Gymkhana which was in a state of hibernation since the closing of the College was roused to life on the return of the students when everything that bore an air of torpid gravity gave place to cheerful gaiety. Anxious to have as quick as ever the means of enlivening the hours of evening as a balance to the "serious consideration" of the rest of the day, the general body of the staff and students met on the 12th of June to elect steersmen for the easy piloting of the course of the Gymkhana.

Dr. Mann as chairman opened the proceeding with a kind welcome to all the students—the freshmen in particular. He expressed his satisfaction at seeing every year more and more students from far and near coming to the College for instruction, and wished that they would have pleasant times there.

The annual report of the Gymkhana was next read by Mr. Bhadkamkar, the retiring General Secretary, who was fortunately able to submit it in person to the meeting. He dealt at length on the work of the different departments which he said was undertaken most successfully owing to the careful attention of the various secretaries. He thanked the Gymkhana Committee for its able management which to a great extent lightened the burden of responsibility that lay on him. The report was accepted by acclamation.

Mr. Bhadkamkar in giving a statement of the Gymkhana accounts showed a balance of Rs. 528-10-6 as against Rs. 256-3-3 of the previous year, a vast saving indeed of which amount it was proposed and carried that Rs. 300 should be put aside in a bank as a reserve fund.

We, on behalf of the students, feel it incumbent on us to accord a hearty vote of thanks to the Committee and none the less to Mr. Bhadkamkar whose position as general secretary was a difficult one. We must agree that through their fine arrangements we had several most pleasant days in the field of sport, and we feel much obliged to them.

The Magazine report was also placed before the meeting and accepted. Mr. V. G. Gokhale its manager was not able to be present for the occasion though his presence would have allowed us the opportunity of telling him how sincerely glad we are for his untiring and unostentatious pains to improve the status of the Magazine.

Dr. Mann, before proceeding to hold the elections presented the Ahmed-Mann medals to its winners, Messrs. Bhadkamkar, Lobo, and Masani and heartily shook hands with them for the honour they had gained which he wished every individual student would covet and strive for.

The elections proved enthusiastic as usual, many names being proposed for each section of the Gymkhana. Dr. Mann was unanimously elected President and Messrs. Knight and Burns, Vice-Presidents. Mr. Ajrekar was re-elected Chairman as he proved himself during the past year a valuable asset to the Committee in dealing promptly with difficulties and in general guiding all affairs with discernment. Mr. R. S. Inamdar was rightly chosen General Secretary. That he has parts for his charge we feel quite assured. And we hope to see him successfully attaining his object of introducing necessary improvements in the Gymkhana.

The following gentlemen were duly elected secretaries for :—

Tennis.	Mr. S. B. Raje.
Cricket.	,, S. R. Godbole.
Football and Hockey.	,, A. X. Rebello.
Gymnastics.	,, M. R. Malihali.
Agricultural Association and Debating Society.	,, V. D. Sa. ,, G. D. Gupta.
Reading Room.	,, B. G. Patel.

The Secretaries will best be enabled to work if the students enter fully into the spirit of the gymkhana and by taking part in everything, learn what else is required to be done and suggest reforms. We hope then, that with the concert of the students, the secretaries will have the satisfaction of having done their duty well at the term of their office.

As it is, we already find Cricket, Tennis and Hockey highly patronised. We cannot urge too strongly the need for our men to practise more regularly so that we might put up a good team. We have this year the much desired facility of having a good ground for Cricket and Hockey. Dr. Mann who felt himself how much we were handicapped in not having a good playground did all he could to get one for us and the only way we can prove grateful to him is by uniting to turn it to best account in sports.

Hockey is holding the lead still and has bright prospects before it. We hope to give good accounts of it in the next number.

We had a very pleasant ceremony on the occasion of the opening of the new Tennis Court on the College grounds which was in course of preparation since last year. The Court is the gift of Dr. Mann to the College to immortalise the memory of his revered mother and has been named the "Mrs. Mann" Court with his consent.

This is another great instance of Dr. Mann's loving concern for his students, and we can never be sufficiently grateful to him for his generosity

The Court was opened by Mr. Smart, the Director of Agriculture, in presence of Mrs. Smart, the staff and all the students. The opening game was played by Messrs. Smart, Paranjpye, Burns and Ajrekar. We feel very thankful to all, especially the guests for having graced this very interesting occasion.

The Secretary has made very satisfactory arrangements for the members of all the dispersed clubs to have an easy chance of a game daily.

The Debating Society has a very assuring attendance this year. The opening address was delivered by Dr. Mann on "The Rab Cultivation of Rice." Dr. Mann in his opening remarks outlined the history of the society and explained how the Magazine had its source from it. He earnestly requested the students to stand up for its advancement.

We must need say the Reading Room is excellently managed by Mr. Patel. It is far more orderly than it ever was. Of course, off and on, a picture or a magazine takes the fancy of one or the other and suddenly disappears from the table. But we trust to the good sense of the students to see that the secretary is ever ready to oblige them if

they wish to have any property of the Reading room and hope therefore that no unpleasant reports come from the secretary.

The Gymnasium has this year several experts at *lathi* play and wrestling, and we should feel obliged if the secretary would occasionally on a holiday arrange for a display by them.

Before concluding, we cannot but express our heartfelt thanks to the retiring Magazine Committee for their honest work during the past year. That they have worked with interest for it is proved by its present popularity. Dr. Mann as usual was heart and soul in its cause. And Mr. Sahasrabuddhe helped most assiduously. We can no longer have the active services of Messrs. Gokhale and Patel, the late Manager and editor, for whose untiring exertions, as we have already said, we shall be ever thankful. Mr. Gokhale managed the finances extremely well leaving with the new treasurer a balance of about Rs. 100/- in excess of the previous year's. We are pleased to insert their likenesses here as being two important factors in the well-being of the Magazine.

The new committee is composed as follows :—

Editors.	Mr. T. Lobo Mr. E. J. Fernando.
Managers.	Mr. G. B. Talvalkar. Mr. Y. N. Khale.
Members.	Dr. H. H. Mann, D. SC. Mr. H. M. Chibber, M. A. Mr. B. N. Bhandarkar. Mr. G. S. Kurpad, B. A.

We regret we have once more to crave indulgence for the late issue of the present number. But we must candidly confess that the elections being held on the 12th of June we found it difficult to gather material enough or to correct the proofs soon enough to be in time. Our contributors would oblige us very much indeed by submitting their articles to the editors or to Dr. Mann at least a month before the publication of any issue and particularly that of the July and March numbers.

We need not remind any one the need of his co-operation for our success.

Mr V. N. GOKHALE, B Ag. (MANAGER)

Mr. B. S. PATEL B. Ag. (EDITOR)

Manager and Editor of last year.

LIST

OF

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OF THE

Poona Agriculture College.

Journals, Bulletins, &c., in the Library of the Poona Agricultural College.

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1. * Department of Agriculture, South Australia, Bulletins. J. 144
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2. * Department of Intelligence, South Australia, Bulletins. J. 157
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3. * Department of Agriculture, South Australia, Journal ... J. 35
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1. New York State Agricultural Society, Transactions ... J. 73
   Vols. I to XXXIII (1847 to 1882).
2. New York State Museum (*a*) Entomological Bulletins. J. 184
   Nos. 1-13, 16-28 (1888-1907).
   (*b*) Reports of the Entomologist ... ... J. 184
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1. * Department of Agriculture, United Provinces of Agra and Oudh, Bulletins ... ... J. 12
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2. * Indian Forester ... ... J. 37
   Vols. 31 to 38 (1905 to date)

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1. * International Sugar Journal ... ... J. 38
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1. State Agricultural Experiment Stations, Bulletins ... J. 201
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B.

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1. Department of Agriculture, Bulletins ... ... J. 135
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Baltimore, U. S. A.

1. * Biological Chemistry, Journal of ... ... J. 69
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1. * Department of Agriculture, Mysore State, Bulletins (Mycological Series) ... ... J. 100
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2. * Planters' Chronicle ... ... J. 113
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3. * Revenue and Agricultural Gazette, Mysore .. J. 142
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1. * Agricultural News of the West Indies ... ... J. 88
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3. * West Indian Bulletin ... ... J. 96
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1. * Jardin Botanique de Buitenzorg, Annales ... J. 133
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1. *Khedut* (In Gujarati) ... ... J. 26
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1. * Department of Agriculture, Bombay, Bulletins ... J. 11
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1. * Queensland Agricultural Journal ... ... J. 34
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1. * Bulletin Agricoale du Congo Belge ... ... J. 178
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1. Departement de l'Agriculture aux Indes neerlandaises Bulletins ... ... J. 139
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1 * Agricultural Journal of India ... ... J. 13
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3. * Agricultural Research Institute, Pusa, Bulletins ... J. 10
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7. * Department of Agriculture, Bengal, Departmental Records ... ... J. 181
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9. * Department of Agriculture, Bengal, Quarterly Journal ... J. 27
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18. * Indian Agricultural Gazette ... ... J. 77
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19. Indian, Agriculturist ... ... J. 19
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20. * Indian Civil Veterinary Department, Memoirs ... J. 107
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27. * Journal of Tropical Veterinary Science ... ... J. 22
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28. Scientific Memoirs by Medical Officers of the Army in India, Series I. .. .. J. 93
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1. * Nature Study Review ... ... J. 143
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1. Journal of Mycology ... ... J. 146
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1. * Journal of Economic Entomology ... ... J. 67
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1. * Cyprus Journal ... ... J. 52
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1. * a. Journal of the American Chemical Society ... J. 72
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F.

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1. * L' Agricoltura Coloniale ... ... J. 66
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1. Central Experiment Station, Cuba, Bulletins ... J. 124
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L.

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1. * Department of Agriculture, Punjab, Bulletins ... J. 17
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1. * Mycologia ... ... J. 203
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11. * Journal of the Linnean Society, Zoology ... ... J. 101
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15. * Kew Bulletin ... ... J. 5
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M.

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3. * Proceedings of the Agri.—Horticultural Society of Madras... ... ... J. 58
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2. Textile Mercury ... ... J. 79
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2. * Philippine *Journal of Science*, Series A—General Science ... ... J. 110
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1. * Journal of the Department of Agriculture of Victoria. J. 32
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2. *Year-book of Agriculture*, Victoria ... ... J. 31
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1. * Agricultural Gazette, Nagpur ... ... J. 59
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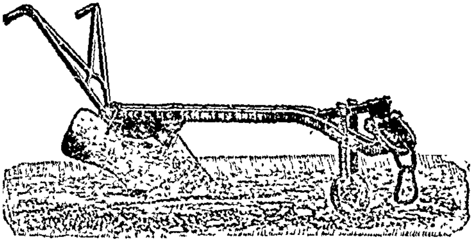

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OCTOBER 1912. I No. 2.

THE

POONA AGRICULTURAL COLLEGE MAGAZINE.

POONA.

PRINTED AT THE "ARYA-BHUSHAN" PRESS, AND PUBLISHED AT POONA

By

Gangadhar Balvant Talvalkar.

1912.

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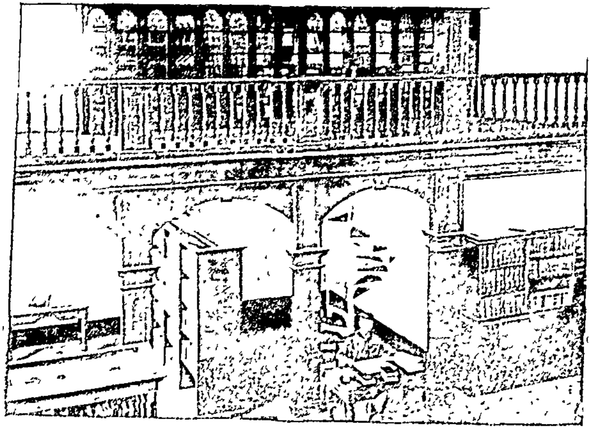

A Corner of the College Library

The Poona Agricultural College Magazine.

Editorial.

IN the last number of the magazine we called attention to the gloomy outlook so far as the monsoon was concerned on the Western side of India. The rains were delayed in an almost unprecedented manner, and until more than half July had passed the greater part of the Deccan lay dry, with not even enough rain to allow of the sowing of crops. Scarcely had the magazine left the printers' hands when the scene changed. The rains broke over Gujarat, the Deccan and the Southern Maratha Country almost at once, and came down in such quantity that in some places, especially in Gujarat and at Belgaum, it seemed as if the excess of rain was going to be an evil only less than its absence. That danger has passed, and now as we write (August 29th) the prospects are excellent, except in some of the Eastern districts of the Bombay Presidency—Ahmednagar, Sholapur and Bijapur, in particular—where the rain has only been as yet sufficient for sowing the crops. Now we await the late rains, which usually fall in September or early October. If these are adequate, the season has every prospect of giving agricultural results above the average.

So far as the present number of the magazine is concerned, we wish to direct attention to several articles of special interest. That by Prof. W. Burns on "The Treatment of the Roots of Fruit-Trees" claims first attention. Fruit culture is widespread in Western India. It is the home of the best mangoes. Orange orchards are common in most parts. Plantains are, as elsewhere, almost universally cultivated where water conditions allow. Pomegranates are regularly grown on the lighter soils. Figs, though more localised, are an important crop. Any notes which may lead to the improvement of a large industry like this will be valuable. The paper was originally read at the quarterly meeting of the Deccan Agricultural Association, and has been kindly offered for publication in this magazine. It contains, as

will be seen, much valuable information—and information not by any means generally known.

During the quarter, a large and representative conference in connection with co-operation, and particularly with co-operative credit societies has been held in Poona. Among the papers read before that conference was one by Mr. G. K. Devdhar on "Co-operation as a Method of Famine Insurance". As Mr. Devdhar was in the thick of operations connected with the recent fodder famine in Gujarat, the paper is of great value, as coming from one who has actual first hand experience with the subject. He has been kind enough to allow us to reproduce it, and for this we owe him our very best thanks.

In a former number, we printed a collection of agricultural sayings from Gujarat. This is followed by a similar collection in the present number from various other vernaculars by our old friend Mr. B. R. Bhadkamkar,—whose article on the cultivation of the '*Mallai*' lands on the banks of the Krishna a year ago was very valuable. Other papers now presented deal with the peculiar band cultivation at Belgaum by Mr. G. L. Kottur and a continuation of the article on the cottons of Gujarat, by Mr. K. D. Kulkarni which was commenced in the last number, and on the cattle of Ratnagiri by Mr. M. N. Padwekar.

We hope that with these and other material to which there is no space to call attention this number of the magazine will be found not inferior to any which have yet appeared.

The Agricultural College Library.

BY

Harold H. Mann.

Principal, Poona Agricultural College.

IN the last number of the Poona Agricultural College Magazine the first part of a collection of lists of the books, pamphlets, and journals in the college library was published, and it is hoped that in every number of the Magazine for some years to come a list of the books which the library contains on some important subject will be issued. This being the case, the present seems a suitable opportunity to give a short account of the origin of the library, of its present condition, and of the purpose which it is intended to serve.

When the Agricultural College was separated finally from its association with the Poona College of Science on January 1st 1908, a few old books were handed over to it at the same time. These, together with a few Government reports and the like, constituted practically the whole library as it then existed. But it quickly grew. Many friends made valuable presentations to it, among the chief being Sir John Muir Mackenzie and Prof. Knight. Beyond this, the necessity of a good agricultural library in Western India so applied to H. E. Sir G. Clarke, the Governor of Bombay that from the year 1909, a very substantial grant was made to put the library into a good condition.

This was done, however, on one condition. The library was not to be a college library, but was to be open to the use of the public, and to become, in fact, a central agricultural library for Western India. This fact has constantly been in mind in all later developments.

Until the new buildings were ready, the library had most inadequate quarters, but in 1911 it was finally transferred to its ultimate position. The room in which it is now placed, and which is shown in one of the illustrations in the present number, is an almost ideal one for the purpose, and it is capable of containing probably about three times the present number of books. The ordinary books are contained in open cases, and are completely accessible to the readers. The journals are mostly housed in closed cases on the galleries in the library, but are available at any time during college hours, and a librarian is constantly present.

The library is divided into divisions as follows :—

Agriculture containing		688	volumes.
Botany (including Evolution) containing		550	,,
Chemistry	,,	538	,,
Zoology and Entomology	,,	238	,,
Veterinary Work and Science	,,	160	,,
Geology	,,	81	,,
Climatology	,,	38	,,
Bibliography	,,	19	,,
Calendars	,,	41	,,
Miscellaneous	,,	338	,,
Journals, Bulletins &c.	,,	1856	,,
Reports	,,	392	,,
Encyclopedias, Dictionaries, Gazetteers &c.	,,	101	,,
	Total...	5040	,,

The number of volumes given are those which were present on June 30th 1912 when the last accounts were made up. Since that time a considerable number have been added.

No catalogue has been published hitherto, and it is not likely tha a complete one will be issued in the near future. The work of com piling one is so great that it would need a special man engaged for a least a year. But the card index which is kept in the library is up to date, and, except for pamphlets and bulletins is practically complete. The indexing of articles in journals, however valuable this may be, is a matter for the distant future.

The library is primarily kept for the use of the students of the college. But any person who is felt to be reliable can have books from the library. These are sent by registered post, and the understanding is that the book is returned by registered post within a fortnight. Practically all books sent out have been duly returned.

I have already shown that the library at present contains 5040 books or a little over. The growth has hence been very rapid, and the following figures show this very markedly.

June	1909 ...	... 1182	Volumes.
,,	1910 ...	... 2780	,,
,,	1911 ...	... 4000	,,
,,	1912 ...	... 5040	,,

A growth like this cannot be made without the expenditure of much money,—and, apart from the numerous gifts of books to which

THE LATE R B NARAYAN VINAYAK GOLE.

I have already referred, the amount spent to the end of June 1912 has not been less than Rs. 10502. This does not include the cost of many of the current journals which are supplied by the Director of Agriculture.

But such expenditure is, I think, well repaid in the present case. If we are to take advantage of the work done and the progress made in Europe and America, in the other tropical countries of the world, and in other parts of India, then we must be able to get at it. To do this involves an up-to-date library, a *living institution* to which the latest literature is constantly being added. And this is what the agricultural college library aspires to be. It has been formed for use, *not for show*,—and it is hoped that it will be used to the greatest extent possible. This is the purpose for which it exists, and if its existence helps an agricultural progress in Western India in any degree, we shall *feel that the expenditure of money and energy in forming* it will have been fully justified.

The Late Rao Bahadur Narayan Vinayak Gole.

BY

S. R. Godbole.

HUMAN life is but like a gliding meteor—it glimmers for a while and is gone. Against the icy hand of death it has no armour. But the actions of the just smell sweet and blossom in the dust.

Such a life passed away only a few months ago in Rao Bahadur Gole, a life which laboured with love in the cause of the scythe and the spade. To do honour to the memory of one who interested himself so sincerely in agriculture, meseems a short sketch of his life will be equitable.

Rao Bahadur Gole was born in the village of Mardha in the Satara district in the year 1865. After his early education at Dhulia and Nasik he joined the New English School at Poona from where he matriculated in 1886. Difficulties came in the way of his higher education and he was obliged to take up an appointment in the District Court where his assiduity gained for him much of that knowledge which was of use, to him for the Pleader's examination later on.

He showed his liking for agriculture by purchasing early, some garden land in the Nasik district. And though unsuccessful in his venture, he obtained later, land at Nasik itself where he got a well dug. Later still he invested more in land and attempted the culture of the grape vine. It was about this time, 1902, that he had an opportunity of accompanying Sirdar Vinchurkar to England where he studied minutely the English farmer's life.

On his return from England, he busied himself with the care of the grape vine and other fruit crops as *mosambi*, *santra*, figs. His labours proved very fruitful and he laid out a special garden for oranges for the improvement of which he collected personally every information, even visiting Rahuri in the Nagar district. For want of sufficient irrigation figs did not thrive.

With the aid of Prof. Burns he experimented successfully in checking the grape vine mildew. When first he observed it, he tried Potassium Sulphide spray and burning the plants as a remedy. But this being ineffective he referred the disease to Prof. Burns who by means of Bordeaux mixture successfully checked the mildew. Rao Bahadur Gole then continued this treatment himself with very good results.

To turn to another feature of his enterprises, when Mr. Hadi's method of sugar manufacture was in high repute here some years back, the people of Nasik collected a sum of Rs. 1200, to experiment the manufacture there. But soon, interest flagged and Rao Bahadur Gole set to work at it alone, and taking the whole sugar-cane crop of a single cultivator he was able to prepare fine sugar. The comparatively inferior yield from cane as compared with the foreign manufacture necessarily made this venture a failure. But he next tried the better preparation of *gul* by the Poona method and with the use of the Poona furnace. His success in this attempt led to the introduction of this method among the cultivators at Nasik, which was his main aim.

He was always enthusiastic in demonstrating and trying to bring in improved methods of cultivation among the cultivators. And though a pleader with his attention always in demand at the court, he employed all the leisure he could command in the pursuit of agriculture. Only a week before his death, he had brought good foreign varieties of vegetable seeds to grow them in the garden attached to his bungalow.

Apart from this hobby, Rao Bahadur Gole was a man who held a high place in public life. From chairman and vice-president he rose to be president of the Nasik Municipality which position he held for years. His abilities and energetic work as head of the municipality secured for him the title of Rao Saheb in 1903. In 1905 he was appointed Public Prosecutor at Nasik in which capacity by his honest and careful dealings he earned the title of Rao Bahadur. This honour he was however not destined to enjoy long as he received it only a day previous to his death.

Rao Bahadur Gole was related to Mr. M. S. Gole, the late Principal of the Fergusson College and a leading member of the Deccan Education Society. He received his education under him and through him obtained that refinement of character and the spirit of doing public good which were so markedly visible in all his actions. He died suddenly on June 15, 1912, leaving, by his unexpected departure, Deccan agriculture poorer by one noble worker for its advancement. He has, we pray, passed peacefully into the realms of bliss satisfied that during his span of life he performed his duty as a good subject to the Deity.

Plantain Cultivation Near Poona.

BY

J. N. Purandare.

AS plantain cultivation is not a very extensive industry in the neighbourhood of Poona, I was tempted to go and see one of the gardens situated at Kondhanpur about 18 miles from Poona on the other side of the Sinhgad hills. I spent the recent vacation at the college in doing so, and the information contained in this article was collected during my visit.

The soil chosen for the plantain garden was of a medium light nature with a porous substratum. This soil is locally called '*karal*'. As high winds prevail in the neighbourhood the variety chosen was '*guji*' which, I was told, stands a considerable amount of wind without injury.

The plants from a plantation in which the trees are grown for the production of leaves are not fit for use where fruit is the main object. Some types are specially cultivated for their leaves.

When a new plantation is to be commenced, the plants put out should already be about three feet high. The land is prepared in the usual way. Pits one foot deep and wide are dug eight feet apart. About four pounds of farmyard manure with some assafœtida (*hing*) water is put in each pit and the plantain plants are afterwards put in. Assafœtida water I was told is added in order to kill any insects which may be in the manure. The first one or two waterings are done by hand. The best season for planting is October as the plants put in June succumb to heavy rains. Watering is regularly done every six or eight days according to the season. Six months after planting, the whole field is hand dug to a depth of about eighteen inches and beds five feet square are prepared for each plant. One month after this digging the beds are again stirred and two to four baskets of manure mixed with the soil in each bed. Regular irrigation is then resumed. Irrigation is never stopped in order to give the plant a resting period but a digging is given just after the rains to destroy all the weeds especially '*harali*'.

Within twelve months of planting the plants flower. All the plants do not flower simultaneously, some flowering a few weeks earlier or later than the majority. The plants before flowering give forth new shoots in the bed, their number varying from three to six. Some people retain all these for the following year while others retain only three. The fruits mature six months after flowering and are ready to be taken down when a yellowish tinge appears on them and they are well swollen. Every plant on an average gives seventy-five to eighty fruits. When the fruits are ready the stem is first cut down and then the bunch of fruits is removed. The plantation lasts for about ten years and then is usually dug up as the beds afterwards get crowded. The plantation that I visited was one acre and twenty-eight gunthas in extent with 1000 plants yielding about Rs. 75 to Rs. 80 per month continuously for six months. The total cost of cultivation and irrigation by a well and a mhot came to about Rs. 150. The cultivator informed me that he sold the fruit at prices varying from Rs. 6 to Rs. 11 for one thousand* according to the size of the fruit and nature of the market. He further informed me that he was required to go over the plantation every eight days for fruits. The seed plants which he originally obtained were bought for Rs. 6 per 100.

* In the market 116 fruits are taken as 100, and eleven times this amount are required to make one thousand A thousand plantains commercially mean therefore, 1276.

The Treatment of the Roots of Fruit-Trees.

(A lecture delivered under the auspices of the Deccan Agricultural Association.)

BY

Prof. W. Burns, B. Sc.,

Economic Botanist, Bombay.

THE subject of this lecture was chosen because it has been my experience that on this matter there is a considerable deal of misunderstanding and a need for advice.

Before going into the practical side of the question let us consider for a little the structure of the root of a tree. When we take a young plant carefully from loose soil, and wash the soil from the delicate branches of the root, we note that there is one region of each of these branches to which soil particles cling most tenaciously. This region is just behind the tip of each delicate branch of the root, and usually extends for about an inch up the rootlet. This is the region that is able to take up water from the soil, because here are developed peculiar hairs which we term root-hairs. These root-hairs are best demonstrated if we grow a seed between layers of wet blotting paper. *The young roots as they protrude from the seed are seen to be covered* with a white felt of hairs. These hairs are the true absorptive organs of the root. If we examine such a root-hair under the microscope, we see that it is a long thin sac lined with the living material which we call protoplasm, and containing a clear fluid called cell sap. Water from the soil can pass through the fine cell wall and the delicate living membrane. Thus the cell sap becomes greater in volume and more dilute. A root-hair cannot hold an indefinite amount of this fluid and water is continually being passed on to the inner cells of the root. As soon as this water reaches the layer of young wood in the root it begins to ascend, for the young wood is a system of pipes specially contrived for the purpose of carrying water upwards; so as soon as the water gets to this region of the young wood it begins to ascend, travels up the stem and finally out to the leaves. Some of the water is used up by the plant as it travels through these organs, and much of it is excreted through the pores of the leaves. It is important to remember that the region of the root-hairs is the only place on the root where water is absorbed. The other older and stronger parts of the root *conduct* water but do not absorb it. *Anything, therefore, which injures the root-hairs,* interferes with the supply of water to the plant.

This continual uptake of water from the soil results in a considerable pressure being developed inside the root, forcing water up into the organs above. This *root-pressure*, as it is called, is one of the factors causing the ascent of water in plants. This can be clearly demonstrated by a simple experiment. A young *pangara* plant may be cut off near the soil and a long glass tube fitted on the cut end by means of a rubber connection. About five days after the experiment set agoing you can see from the movement of the water in the tube how much water has been forced up in that time. The pumping force of the root varies in different trees. In the grape vine where the water has to travel a long distance it can support a column of 39 inches of mercury.

Let us now consider what are the conditions in which the root-hairs can best fulfil their duties, and from these observations infer what methods of treatment of roots are rational, comparing these inferences with facts of our own and others' experience. In the first instance it is necessary to remember that the root-hairs and all the younger cells of the root proper are living cells and so require all that living matter stands in daily need of. Before these cells can do any work for the benefit of the rest of the plant they must themselves be healthy. One of the first requisites for living cells is a free supply of good air. The roots must breathe. In Nature there occur certain trees which have become adapted to life in swamps where the soil is close and where water fills up all the soil interstices. These plants have special arrangements for the supply of air to their roots. If you go to the bunder at Bassein you will see in the mud flats there great areas of a plant locally called *Tiwar* and in scientific language *Avicennia alba and A officinalis.* The roots of this plant send up peculiar projections above the ground. These are breathing roots. They are full of porous tissue through which the atmospheric air easily passes to the roots in the mud, just as a diver is kept in connection with the upper air by means of the tube attached to his helmet. This fact shows the extreme importance of air to tree roots. The soil, therefore in which the roots are situated must be of such a texture that there is a sufficient interchange of the air in the soil and atmospheric air. The air contained in the soil is not exactly the same as that above the soil. Within the soil oxygen (the life giving element of air) is always being used up for processes of decomposition of organic substances, and the roots are continually taking in oxygen and giving off other gases. The air of the soil is therefore as a rule poorer in oxygen and richer in other gases than the air above the soil. What conditions then affect the

permeability of the soil to atmospheric oxygen? The two most important are (1) the size and degree of cohesion of the soil particles and (2) the amount of water in the soil. With regard to the first point, if a soil is caked and hard, although air may penetrate into the large crevices which are produced when such soil splits, still the inside of large masses of soil is insufficiently aerated. Small grained soil after watering tends to clog and cake like this. Larger grained soils cake less readily with regard to the second point. The condition of the ideal soil for fruit trees may be compared to that of a fine sponge which has been soaked in water and thoroughly wrung out. Every part is covered with a film of water and yet the whole mass is permeated by air. Overwatering fruit-trees have therefore two serious effects. In the first place, the spaces in the soil which should be occupied by air are instead filled up by water, and in the second place, the soil afterwards cakes and hardens, especially if it is at all clayey, into an impermeable mass. It is worth while noticing here that the water in the soil which the roots absorb is not that which lies freely in the soil interstices, but the film of water which remains surrounding the soil particles when the excess has drained through. The root-hairs apply themselves closely to the soil particles and absorb this film. We get here a useful hint as to the subsoil of a fruit plantation. It is most desirable that it should be of such a kind as to allow of good drainage. Probably one of the reasons why the mango succeeds so well at Goa and Ratnagiri is on account of the porosity of the laterite on which the trees grow. A murum or laterite subsoil ensures the passing through of superfluous water. A clay bottom means that there will be danger of water logging. We have arrived at two points of practical importance. In choosing a site for a fruit garden, we must see that the soil is of such a texture that it is readily permeable to air and that the subsoil is of such a nature as to allow of the draining off of superfluous water. If the soil and subsoil are not naturally of the desired consistency and character, still we can by special treatment bring about the conditions we desire to some extent at least. The texture of the upper soil we can change by manuring and cultivation. Dry sandy soils need much bulky manure from the cowhouse or stable, and there is scarcely any soil that will not benefit from green manuring. These organic manures increase the porosity of the soil, enhance its water-holding capacity and are themselves valuable additions to the plant food of the soil. Cultivation is essential both before and during the life of the plants. It has been again and again proved that deep and thorough ploughing and cultivation before planting the trees is an excellent investment of time, money and labour. With uncultivated

land it is well to do this first cultivation as much as a year ahead of the time of planting During that period the land can be occupied with other crops which will give some return for the out lay, keep down weeds, and maintain the looseness of the soil. On the spots where the pits are to be made however, there should be no crop during the three months previous to planting. The pits themselves and the subsoil removed from them should be exposed to air and light.

With regard to the subsoil if it is not sufficiently porous the defect must be remedied by means of drainage. If drainage is not arranged for, the effects of overwatering in such soils may be very serious indeed. In the case of orange trees, rotting of the roots sets in and the trees gradually die. Moreover the water may rise again to the surface bringing with it subsoil salts and making the land salt and unfit for fruit trees. Such a case was brought to our notice recently. Orange trees in a certain plantation showed a peculiar *yellowing of the leaves and a gradual* death of the branches. The affected trees occurred in clumps here and there in the garden. The soil at the foot of trees in these groups was always occupied by succulent weeds of a type associated with salty conditions. The water of the well in the garden was not salty and the previous manuring was not such as to lead us to suspect that the disease could have been caused by it. Analysis of soil from the neighbourhood of the affected trees, showed a large proportion of salts. All the indications therefore were that the disease was due to increase in the salts of the soil due to defective drainage. Dr. Mann, who visited the plantation to advise on the matter counselled the digging of narrow deep drains at frequent intervals throughout the diseased area with an outfall beyond the garden. This advice will we hope be acted upon and we await the result next season.

Mr. D'Cruz of Bombay informs me that he was once called to a garden in Bombay where he found large white patches on the soil. The plants had a sickly look about them and the shrubs were all stunted. The water of the well on analysis was found to contain a considerable amount of salt but not enough to do the plants harm if the drainage had been good. *By deep digging and replenishing the soil, the condition of* the garden was much improved. This of course was not a case of subsoil salts, but of defective drainage causing on accumulation of salt from the well water. Mr. Joshi of Bassein suggests that another way by which subsoil salt can be prevented from ascending is to spread leaves and grass on the surface of the soil round the trees in the basin where the water is given. Evaporation from the surface of the soil is thus

considerably checked, cracking of the soil prevented, weeds also stopped and the roots protected from heat. *Mr. Joshi has used this method at Bassein with excellent results for the last four years.* The leaves and grass used are simply what the coolies cut when weeding. The system has been used for young mango trees, *chikus*, *sitaphal*, rubber and plantains, also coffee and cocoa.

To ensure a supply of air to the roots of standing trees it is essential that the soil round the trees should be broken up occasionally to prevent caking. The breaking up process is best done 3 or 4 days after each watering. The *khurpi* or better the *tikac* (pick) may be used for this operation ; the top layer of soil should be pulverised to act as a porous mulch, and a rake is excellent for this purpose.

Weeds growing under fruit-trees have several serious effects on the roots. The roots of the weeds occupy the ground and interfere with the upper roots of the fruit-trees Water is stolen by them which the fruit trees can ill spare. The surface of the soil is blocked by them and the exhalation of their roots serve to poison the soil atmosphere for the tree-roots. The operation of breaking up the upper layers of soil to aerate the roots also removes the weeds, if properly carried out. In three separate cases of mango and orange trees in the Ganeshkhind Botanical Garden and one of old orange trees in a neighbouring plantation thorough digging to 1 foot deep has been of immense advantage and stimulated rich growth in the case of the Ganeshkhind Garden oranges, combined with other treatment, has caused extraordinary fruiting. It is necessary to see that the coolies don't injure trees when digging. The consideration of weeds under fruit-trees naturally leads to the question of subcrops. The same principles must be observed here. Subcrops must *not* interfere with the water supply or aeration of the roots of the main crop. Close-growing crops and long season crops are therefore out of the question. The former include all the grasses and cereals and the latter such plants as cotton &c. Nevertheless I have seen *jowar* grown between mango trees without apparently adversely affecting them, but these trees were large and old and stood far apart. Their roots capped deeper layers of soil than were seriously affected by the subcrop. Still the principle holds. The growing of rice between mango trees as is done in some parts of the Konkan is a practice absolutely against the health of the roots of the mango, which is not a swamp plant. While the fruit trees are young brinjals, onions, chillies, and other short-season crops which are not close growing can be taken between them, but these crops must not be planted close to the trees. A circle having a diameter of

about the breadth of the crown of the tree must be left clear round the base of each stem.

Supposing we have planted out our fruit-trees fifteen feet each way, and that the breadth of the crown of each tree is on the average two feet, then we should leave a circle of three feet diameter clear all round the tree, unoccupied by subcrops. The breadth of the crown of a tree in its early stages roughly corresponds to the area occupied by the roots. The next and succeeding years the dimensions of the tree will increase, and our area for subcrops will correspondingly decrease, until, when the crowns of the trees are in contact there is no space for subcrops at all. It is important that the height of the subcrop should be less than that of the fruit-trees, for if the fruit-trees are shaded by the subcrop then they grow long and lanky. When the subcrop is finally removed and the trees have to stand by themselves this long lanky stem proves to be weak and useless.

Let us now consider the life of a fruit-tree from its seedling stage to its adult condition with special reference to its root treatment.

Seeds are usually sown in pots or boxes or even in shady places in the field. Some fruit-trees such as guavas, are generally grown direct from seed and the others which are grafted or budded have their stocks grown from seed, so that we can consider the plants in their early stages as of one kind whether grafted or not, later on. In the case of plants such as mango stocks, the early life of which is spent as a rule in pots, special care of the roots is needed. In the first place there *must* be a hole in the bottom of the pot to allow of the draining away of surplus water. This hole should be covered inside by a piece of curved tile with the concave side down to keep it open and next to it should come a layer of dry leaves to ensure that fine soil is not washed down and the aperture consequently blocked. On top of this should come a mixture of medium sifted soil, sand and leaf mould, in which the seed should be planted. Daily watering is necessary. The outside of the pots should be occasionally washed and scrubbed to allow of air penetrating the earthenware, and the surface soil of the pots must be stirred at least once in three days. A small fork is best for this purpose. It must be remembered that the roots in a pot are in highly artificial conditions and are therefore much more susceptible than are roots in the soil of fields.

For this reason, too, plants should be taken out of the pots and transplanted to the field at the earliest opportunity. Mr. D'Cruz of

Bombay writes : "The way I advise mango seedlings to be grown is to dig a trench say 9" deep and in the bottom lay a corrugated iron sheet, which should be covered with broken potsherds with the concave portions inverted. Over this a layer of coir or teased matting may be spread and then a layer of sand and leaf mould covered over, in which the seeds should be inserted. After germination the roots do not go beyond the layer of corrugated sheet. The seedlings could therefore be removed easily without great injury to the pots used for grafting purposes or to their final quarters for growing as fruit-trees." If plants in pots have been neglected and it is desired to revive them, then the plant must be carefully extracted from the pot with the ball of earth adhering to the roots. This earth should be carefully removed. Dead, diseased and straggling roots should be pruned off by a sharp knife. Matted roots should be separated and the main root shortened, in trees which will tolerate this treatment; mangoes do not stand shortening of the main root, orange trees do. Then the plant should be transplanted into porous gravelly soil in a small pot and kept in a warm moist shady place till recovery begins. The number of leaves on this plant should be reduced by pruning off a few branches of the shoot. While the plant is recovering, water should be given *very sparingly* as the plant has not yet developed new root hairs to absorb it. Root hairs closely adhere to the side of the pot and the soil and are torn off in transplanting. To get new root hairs new roots must be developed. If much water is given before the formation of new absorbing roots the roots will rot and all the labour will be in vain. When this plant begins to show signs of returning vigour it may be removed to a slightly more exposed place and thus gradually accustomed to being brought back to its normal surroundings.

It is possible to grow fruit-trees in pots during their whole life, getting produce from them in such conditions, but this is a special branch of the subject and I cannot go into it at length. Suffice it to say that the success of this branch of horticulture depends largely on the measures taken for the health of the roots, similar to those which I have just described.

Our next question is: How should the roots be treated in transplanting? The pit in the field should be dug fairly big, about three feet each way. The pit should have been dug and left open to the air for some weeks previous to planting, to weather the subsoil both in and out of the pit. Well exposed soil should be put in the bottom of the pit mixed with manure, but manure should in no case be placed in direct contact with the root of the tree. Previous to

putting in the tree a stake should be driven into the pit. To this the tree will be tied. To put in the stake after planting the tree means that some of the roots will be injured. Before planting out fruit-trees in their final places it is well to harden them to their new conditions. If this is not done the change may be so violent that the trees will not survive. This has occurred in my experience in planting out mango plants that had been long in the nursery. One must remember that in the nursery the plant has been in a more or less shady spot protected from direct sun, from wind, and from extremes of temperature. In the field it is in the open, gets the direct sun, and has all the change of temperature that is going. Moreover the root system is always slightly injured in the transplanting process, so that all the circumstances combine to make the plant lose water rapidly and replace it slowly. No wonder that after a day the leaves begin to droop and wither and that finally the whole plant dries up and succumbs. The process of gradually accustoming a plant to new surroundings is called *hardening*. One very simple method of *hardening* is to take the plant still in its pot out to the fields and plunge the pot in the soil near the place where it is to be transplanted. The plant should also be shaded during the first few days. The shade may then be taken off and the plant left some time longer, still in the pot. Finally the plant should be taken out of the pot and transplanted into the pit prepared for it.

Mr. Paranjpye, Assistant Economic Botanist, who has had an extensive experience of planting budded orange and lemon trees informs me that if the plants are put out after budding with the bud side facing the direction of the prevailing wind then the branches from the bud grow evenly on all sides, but if the plant be so placed that the bud is away from the wind then the plant grows lop-sided the side towards the wind being stunted.

Before placing the tree in position in the pit, the ball of roots should be gently eased out, and straggling and diseased roots removed. The tree should then be set on a little mound in the centre of the pit and the roots spread out over the gently sloping sides of this mound. It is a fatal error to have the base of the stem rammed down into the pit and the ends of the roots high up at the edge of it. The soil should now be thrown lightly over the roots and gently pressed down on and between them with a wooden peg. In transplanting, it is essential to make a compact connection between root and soil, so after further addition of soil and further packing with the peg the whole surface may be trodden over several times and earth added till the plant

is buried up to the same point as it was in the pot it previously occupied. A good soaking of water should then be given. The shoot should be pruned, reducing non-essential branches by about a third of their length and retaining intact such as are necessary to make a good crown. The tree may now be tied to the stake. The string should not come directly into contact with the tree but should be padded with cloth. When tying the string also, it should be brought once or twice between the tree and the stake to ensure a better and tighter binding and to keep the stake from rubbing on the tree. Tying the tree directly against the stake may result in the tree taking the form of the stake and in the case of a long irregular stake this would mean a most unsightly and useless trunk.

The stake should be removed at the earliest possible safe moment, for if the tree gets to rely on the stake it becomes weak stemmed, and besides there is apt to be compression of the trunk at the points where the tree is tied to the stake.

In trees which are intended for further transplantation such as a nurseryman's stock, it is desirable to transplant several times keeping the long roots pruned in, so that there is a great number of short branches with many rootlets. This means that the whole absorptive system is in small compass and readily transportable. If the tree has to be carried some distance before being planted, the ball of roots and earth should be tightly tied up in sacking and steaded somehow during transit. In trimming and pruning roots a sharp knife should always be used and the cut made in a sloping manner on the under side of the root.

There remains to be described one important series of operations which it is necessary to carry out on trees which have more than one flowering season per annum. Such trees are the guava, the pomegranate, and the orange. These may flower in January at the time of the mango blossom thus giving the fruit season known as the *Amba Bahar*, or they may flower at the break of the rains in June when the fruit season is called the *Mrig Bahar*; or in September when the season is called *Hatti Bahar*. The *Hatti Bahar* is not usually taken because it is practically impossible to cause trees to rest during the preceding wet months, but the *Amba Bahar* and the *Mrig Bahar* can be forced at will according to the season at which water is withheld from the trees. This withholding of water is usually accompanied by a partial exposure and pruning of the roots of the tree. For the the *Mrig Bahar* it is usual to withhold water during all April, and half of May to expose the roots from 3—4 weeks during that period, according to the nature of the soil,

longer in retentive soil, shorter in pervious soil. For *Amba Bahar* water is withheld half of December and all January for oranges and roots exposed as before. The object of these operations is to check the vegetative growth of the tree This check in leaf formation leads to an enrichment of the resting buds, and when water is again given and the tree awakes from its rest, these buds produce flowers or flowering branches. The question now arises which roots should be pruned at the time of exposing the roots. How far also should the roots be exposed, and for how long should they be exposed? Consider what the root system of a ten year old orange tree is like.

The important feeding parts of the roots are the delicate tips at the end of the root branches. We must not injure them. Hence we cannot sever the strong roots, that conduct water from these feeding roots to the trunk. We can however with safety remove these later formed roots that occur on the main branches nearer the tree. It is wise to do this as we thus increase the check on the tree without materially damaging, it. It is also to be noticed that old roots heal with difficulty. Younger ones heal readily.

The degree to which the roots should be exposed is governed by the same principles. We do not wish to cause the delicate feeding roots to wither up, so we do not expose them. The first two feet of the big roots can be exposed with safety in a ten year old tree. The exposure and partial drying of these roots also acts as a check on water conduction.

On refilling the pits after a period of exposure it is customary to place manure in the pit along with the replaced earth It is necessary to see that the manure is well mixed with the earth before replacing. Orange and other trees may not be pruned if making too rapid vegetative growth at the expense of their fruits but root pruning should be resorted only if the gentler method of exposure of the roots fails to have the desired effect. In severe root pruning it may be necessary to cut some of the strong roots as well as the coarse lateral roots. The cut should always be on the underside of the root. It is usually unsafe to interfere with the tap root of big trees. It must be most emphatically stated however that no amount of root pruning will make up for a neglect of certain other commonsense precautions. In many gardens which I have visited, the owners expect fruit from trees that are crowded, shaded, and kept damp by a miscellaneous collection of other trees. No root pruning will take the place of system and care in the arrangement of the plantation. Another common belief is that some artificial manure will undoubtedly cause the trees to fruit. No artifical manure is any use while the conditions of the garden are unhygienic. It is as if a man

should demand medicine for a disease which is due to his refusal to wash himself. In conclusion I have to express my thanks to Mr. A. M. D'Cruz, Horticulturist, Bombay, to Mr. G. B. Patwardhan and Mr. H. P. Paranjpye, Assistant Economic Botanists, and to Mr. P. G. Joshi, Bassein for the valuable assistance that they have given me in the preparing of this paper.

A Note on the Bund Cultivation at Belgaum.

BY

G. L. Kottur, B Ag

IN the heavy rainfall tract of the Belgaum and Khanapur talukas of the Belgaum district where rice is the principal crop, the cultivators carefully level their fields and check them so as to hold the rain or irrigation water equally distributed. The size of the checks largely depends on the topography of the land. If the land is gently sloping the checks are as big as one acre but if the slope is considerable, as is often the case, smaller checks are laid out, and consequently a large portion of the area is covered up in the embankments bordering the checks. In order therefore to make good this loss a half hearted attempt is made by the rice growers to crop their bunds and get some return from them. This method of bund cultivation although not very systematic is worth being adopted with certain modifications, in other parts of the Presidency, where similar conditions exist.

Bund crops.

The crops that are generally selected for growing on the bunds are :—*Ambadi* (*Hibiscus cannabinus*), *Tur* (*Cajanus Indicus*), *Meroli*, a kind of sweet *Wal* (*Dolichos Lablab*), *Vagre* (a variety of *jowar*), *Mug*, *Udid*, and sometimes castor.

The seeds of these are mixed according to the fancy of the owner and sown in the furrow on the top of the bunds. The seeding is generally very thick, 2 to 4 lbs. of seed being used for a bund 100 feet long. It is done as soon as the soil on the bunds is moistened by the first showers of rain about the middle of June without any previous treatment. The plants on this account are much crowded, poor in vigour and indiscriminately mixed.

In addition to the crop on the top of the bund, *vagre* seedlings are also transplanted on the sides at some distance from the top. *Vagre* is a kind of *jowar* having reddish grain. It grows well under conditions of moderately heavy rainfall. A sprinkling of this *jowar* is invariably found in all the rice fields round about Belgaum. In years of scanty

rainfall it is allowed to mature to grain which gives a substantial help to the cultivator when his rice crop fails. But under ordinary conditions the *jowar* plants in the rice field are fed to cattle as soon as the rain is sufficiently heavy to interfere with their growth. Even in the young stage they are not calculated like so many *jowars* to do any harm to the cattle. This may be due to the fact of the large supply of water they get, for the cultivators in the Gokak canal tract always consider that irrigated *jowar* can be safely fed, while dry *jowar* is dangerous and poisonous as fodder when young. The transplanted seedlings withstand heavy rain, grow vigorously, and give a good outturn of grain and fodder.

The *tur* plants are harvested in February—March. The *ambadi* is cut at about the same time and fibre extracted. The *meroli* pods are picked several times in the months of January, February and March. The produce which varies very much in quantity is generally retained for home consumption. The *meroli* pods however fetch a good price, there being a great demand for them in the Belgaum market. But if the crop is poor as is often the case on account of improper care and cultivation of the bunds it is entirely fed to the bullocks soon after the harvest of paddy.

Every rice farmer owns on an average, eight acres of land cut up into about twenty beds or checks. Naturally he is in possession of 30 bunds each 130 feet long excluding the boundary ones which are only utilised by their common owners for heaping their weedings. If these bunds are properly cared for, they can be made to yield a net profit of Rs. 20 per annum equal to one-sixth of what is commonly gained from the crop occupying the ground between them.

Improvements.

The bunds do not receive any manure although they are annually cropped. The addition of farm yard manure in conjunction with some quick acting fertiliser is desirable. The manure should be applied in the furrow some time before sowing. The seed should be dibbled at regular distances so as to avoid the overcrowding of the plants. It is better to sow one or two crops then to mix a number of them without any definite object. Under the present system the different crops do not even pay the charges of harvesting and threshing them. The laws of rotation should be obeyed and crops changed accordingly, otherwise there is great fear in the near future of insect enemies which, from recent inquiries, appear to be rapidly increasing on the bunds.

* A confirmation of the correctness of this belief was recently obtained in this laboratory. Dry and irrigated *jowars* of the same age were examined for Hydrocyanic acid. The former contained it, the latter did not.—H. H. Mann.

A Note on the Germination of Papaya Seeds.

BY

G. D. Mehta, L Ag., B A, &c. and
L. B Kulkarni, L. Ag.

A complaint was received at the Ganeshkhind Botanical Gardens, Kirkee, in the beginning of September 1910 about the failure of germination of papaya seeds sent to a gentleman in Calcutta.

It was then decided to test the germination capacity of the seeds contained in the above mentioned sample at the seed testing laboratory in the Agricultural College, Poona. So a consignment of papaya seeds from the sample was sent on the 25th of September 1910 to the College laboratory. We examined these carefully. The seeds were put for germination in a glass jar filled with sterilized wet sand under the laboratory conditions (temperature-between 25°C and 30 C, on the 26th September).

For nearly a month and a half not a single seed was observed to be sprouting. All of the seeds put for germination in the jar looked quite healthy and were unattacked by any kind of mould. It might be worth while to note here that when a dead seed is put for germination in wet sand, it gets at once attacked by some kind of mould or other in a couple of days. It was assumed from the fact that no moulds appeared that the seeds were not dead in any case, but that some external cause was hindering the germination. On the 10th of November 1910 two seeds were noticed to have sprouted and later on in December, some few more were found to have germinated.

This sort of result led us to resolve upon undertaking a regular investigation of the period of vitality and the germination capacity of papaya seeds. The irregularity of the germination of the seeds from the first sample led us to believe that perhaps the thick testa of the seed might be hindering the penetration of moisture to the embryo within the seed just as is often found to be the case with some so called "hard" leguminous seeds.

A fresh scheme of experiments was soon prepared and a regular investigation of the germination capacity and the period of vitality was undertaken. The first sample of the new series from the Ganeshkhind Gardens was received at the laboratory on the 31st of January 1911. The seeds from this sample were put for germination in a specially prepared and sterilized flower pot. Since then fresh samples

have been regularly received at intervals of eight to ten days and put down regularly for germination. But the results obtained till the first of March were very discouraging. Not a single seed was found to be sprouting.

Owing to want of space this experiment was then discontinued in the laboratory and it has been carried on since that time in the Ganeshkhind Botanical Gardens.

The results of the seeds sown from March 1911 and also those sown before March *i. e.* sown in September, November and December 1910 are tabulated below. All the seeds (except where it is mentioned that they were fresh) were collected in 1910—from January to May.

These experiments have been thus regularly made from March 1911 to the end of March 1912. From the table the following conclusions can be temporarily drawn :—

(1) The germination capacity varies according to the season of the year.

From March to the end of May (summer) the percentage of germination varies from 8 to 25 : average may be taken as 12 and the period of germination is 36 days gradually decreasing to 9 days.

During the monsoon (June to the end of August) the percentage varies from 52 to 88, the average being 60. Period—11 to 23 days except in the case of Ceylon, a foreign variety, which took 42 days.

From September to the end of October the percentage is very low namely 4 to 12 ; period is from 15 days to some months in many cases.

In November when there were slight showers the percentage again increased, say from 12 to 40—period 1 to 23 days.

From December to March again the percentage of germination varies from 4 to 20 except in one or two cases, and period increased from 20 days to months even till June.

This shows that the best and safest season is the beginning of the monsoon.

(2) Seeds retain their vitality for a long period in the soil. This is clear from the instances. 50 per cent seeds sown in August 1911 germinated in June 1912.

(3) Fresh sown seeds germinate a little earlier than dry seeds.

The seeds used above were not from one tree. They are a mixture. As this experiment is being continued again this year we hope that more complete results will be obtained next year.

Variety.	No. of seeds sown	Date of sowing	Date of germination.	No. of seedlings.	Period (approximately).	Remarks.
Country	25	29 9 10	22 10 10	2	8 months in all.	
			12 11 10	3		
			3 6 11	5		
Ceylon	25	4 11 10	24 3 11	8	140 days.	
Country	,,	18 12 10	10 4 11	5	113 ,,	
,,	,,	5 3 11	10 4 11	3	36 ,,	
,,	,,	11 3 11	2 4 11	4	22 ,,	
,,	,,	17 3 11	6 4 11	6	20 ,,	Fresh seeds dried of the above fruit.
,,	,,	22 3 11	13 4 11	4	22 ,,	
,,	,,	3 4 11	22 4 11	6	19 ,,	
,,	,,	18 4 11	3 5 11	6	15 ,,	
,,	,,	20 4 11	5 5 11	2	15 ,,	
,,	,,	26 4 11	5 5 11	4	9 ,,	Fresh seeds dried of the *same fruit.*
,,	,,	29 4 11	13 5 11	6	14 ,,	
,,	,,	29 5 11	12 6 11	13	14 ,,	
			15 6 11	4	17 ,,	
,,	,,	1 6 11	13 6 11	14	12 ,,	Fresh dry of the same fruit.
			16 6 11	3	15 ,,	
,,	,,	3 6 11	16 6 11	12	13 ,,	
			18 6 11	4	15 ,,	
,,	,,	5 6 11	19 6 11	16	14 ,,	
			22 6 11	6	17 ,,	
,,	,,	10 6 11	21 6 11	15	11 ,,	
			22 6 11	4	12 ,,	
,,	,,	12 6 11	24 6 11	14	12 ,,	
,,	,,	16 6 11	10 7 11	17	24 ,,	
Ceylon	,,	17 6 11	20 7 11	12	42 ,,	
Country	,,	18 6 11	11 7 11	13	23 ,,	
,,	,,	21 6 11	11 7 11	14		
,,	,,	29 6 11	15 7 11	16	16 ,,	
,,	,,	4 7 11	17 7 11	16	13 ,,	
,,	,,	12 7 11	26 7 11	19	14 ,,	
,,	,,	17 7 11	2 8 11	20	16 ,,	
,,	,,	25 7 11	7 8 11	15	13 ,,	
,,	,,	1 8 11	19 8 11	13	18 ,,	
,,	,,	7 8 11	26 8 11	14	19 ,,	
,,	,,	11 8 11	29 8 11	14	18 ,,	
,,	,,	14 8 11	2 9 11	8	19 ,,	
,,	,,	18 8 11	9 9 11	2	22 ,,	
Bazar.	25	18 8 11	15 10 11	1	Approximately 6 months and a half.	Seeds commenced to germinate in October and continued till February. Still % is low.
			14 2 12	2		
			16 2 12	1		
			24 2 12	1		

Variety	No. of seeds sown	Date of sowing.	Date of germination.	No. of seedlings.	Period (approximately).	Remarks.
Bazar	,,	18 8 11	23 11 11	1	Approximately 10 months.	Ditto in November and Do.
			16 2 12	3		till June %
			12 6 12	[illegible]		is high.
,,	,,	18 8 11	16 6 12	12		Seeds retained
Country	,,	21 8 11	8 9 11	3	18	their vitality till
,,	,,	31 8 11	15 9 11	2	15	June 10 months.
,,	,,	5 9 11	20 9 11	2	9 months	%50.
			14 6 12	[illegible]	nearly.	
,,	,,	19 9 11	4 10 11	1		
			15 6 12	[illegible]	8 do.	
,,	,,	11 9 11	5 10 11	2	16 days	
			16 6 12	[illegible]	9 months nearly	
,,	,,	25 9 11	26 11 11	8	61 days.	
,,	,,	26 9 11	2 11 11	3	37 ,,	
,,	,,	5 10 11	10 11 11	4	36 ,,	
,,	,,	9 10 11	6 11 11	11	28 ,,	
,,	,,	16 10 11	9 11 11	9	24 ,,	
,,	,,	23 10 11	15 11 11	8	23 ,,	
,,	,,	28 10 11	25 11 11	3	28 ,,	
,,	,,	30 10 11	8 2 12	12	nearly 4 months	
,,	,,	6 11 11	29 11 11	7	23 day	
			6 6 12	4		
,,	,,	21 11 11	Not germinated.		nearly 7 months	
,,	,,	30 11 11	12 6 12	11	nearly $6\frac{1}{2}$ do.	
,,	,,	4 12 11	26 1 12	4	53 days.	
,,	,,	14 12 11	2 2 12	1	50 ,,	
,,	,,	29 12 11	25 5 12	13	nearly 5 months	
,,	,,	4 12 11	18 1 12	2	45 days.	
			22 1 12	[illegible]	49 ,,	
,,	,,	14 12 11	27 2 12	1	65 ,,	
,,	,,	22 12 11	23 1 12	1	32 ,,	
			30 1 12	$\frac{3}{4}$	39 ,,	
,,	,,	29 12 11	26 1 12	5	28 ,,	
			15 2 12	3	48 ,,	
			22 2 12	2	55 ,,	
			1 3 12	1	62 ,,	
			16 6 12	$\frac{7}{13}$	107 ,,	
Country	25	3 1 12	29 1 12	6	26 ,,	
			4 2 12	[illegible]	32 ,,	
,,	,,	8 1 12	31 1 12	3	23 ,,	
			6 2 12	[illegible]	29 ,,	
,,	,,	14 1 12	16 2 12	2	33 ,,	
			23 2 12	1	40 ,,	
			28 2 12	1	45 ,,	
			8 3 12	[illegible]	53 ,,	

Variety.	No. of seeds sown.	Date of sowing.	Date of germination.	No. of seedlings.	Period (approximately).	Remarks.
Country	100	19 1 12	16 2 12	1	28 "	
			16 6 12	16	nearly 5 months	
		23 1 12	1 3 12	1	37 days.	
"	25	10 2 12	12 3 0	1	30 "	
"	"	19 2 12	25 3 12	1	34 "	
"	"	20 2 12	19 3 12	2	27 "	Seeds from hermaphrodite plant.
			20 3 12	3	28 "	
			23 3 12	4	31 "	
			25 3 12	2	33 "	
"	"	23 2 12	15 3 12	11/17	20 "	
			20 3 12	4/16	25 "	Seeds sown in box.
"	"	24 2 12	17 3 12	1	21 "	
"	"	26 2 12	18 3 12	1	20 "	
			19 3 12	1	21 "	
			25 3 12	2	27 "	
			27 .3 12	2	29 "	
			31 3 12	2/8	33 "	
"	"	8 3 12	7 4 12	3	30 "	
"	"	20 3 12	15 3 12	2	26 "	
"	"	28 3 12	29 3 12	1	32 "	
"	"	8 4 12	3 5 12	2	25 "	

A Note on Co-operation as Measure of Famine Insurance.

BY

G. K. Devdhar, M. A.,

Servants of India Society.

NOW that the famine in Gujarath and Kathiawar is fortunately ended and has become a matter of past history, its lessons are occupying the minds of some thoughtful and earnest men who have the interests of Indian agriculturists at heart. The recent famine was mainly a fodder famine; and one of its valuable lessons is the condition of preparedness to promptly deal with the situation created by the total failure of crops and the consequent scarcity of fodder supply. This question of readiness to fight out such a famine by affording assistance to agriculturists in the shape of fodder or money to purchase it, from the moment the signs of an approaching famine become imminent, centres round the eternal problem of funds to be utilized for the purpose of either storing large quantities of hay ready for immediate use or for the purpose of helping the agriculturists with money grants to meet their various wants during the period of stress. To achieve this end two or three schemes have been proposed. Broadly speaking, they are based upon the principle of securing some sort of famine insurance. Without, however, entering into any examination of the merits of these recommendations, let us ask ourselves the question whether we co-operators have any scheme to propose, calculated to promote the same object; and this note is written with a view to attempt an answer to this question from the stand-point of a co-operator.

Any scheme which has for its immediate object the granting of facilities which the agriculturists as a class so badly need, particularly in India, to tide over the evil effects of a famine must be based upon a foundation that will develop self-reliance, sense of responsibility thrift, and fore-sight on the part of the agriculturists and that will organize their credit. Without these the superstructure cannot be permanent and abiding in its results. The history of agriculture in all countries where it has prospered under modern conditions boldly points out to the fact that co-operation has very largely supplied these needs; and, while giving the agriculturists a comparative immunity from the evil effects of famine, if not from famine itself, it is co-operation alone which has put the agricultural industry on a sound economic basis.

There is no industry which is so much exposed to the freaks and frowns of seasons as the industry of agriculture and this great element of uncertainty enters so largely into the prospects of agriculture that its position in a country like India is rendered very precarious owing to this and several other causes. A famine is far-reaching in its effects. It affects most of the industries in a country, in a smaller or greater degree; but the one that suffers most at its hands is agriculture which forms the bed-rock of numerous industries and many industrial and commercial activities. Though the ravages of famine paralyse for a time industrial fabric of a country, it is agriculture that receives the hardest blow on account of its resources which are already very meagre being exhausted and because of the credit of the agriculturists having sunk very low. It thus takes agriculture very long to recoup its lost strength and vitality If, therefore, these dangers are to be averted and agriculturists are to be rescued from this element of uncertainty of prospects, we must think of measures of insuring agriculture against famine, and the most effective measure of famine insurance in the interests of agriculture is, in my opinion, the organization of Co-operative Credit Societies.

It is possible that at one time or another some portion of this vast Indian continent may find itself in the grip of famine or scarcity of food. But with the advancing tide of modern industrialism it is refreshing to note that the rigour of famine at the present time is considerably mitigated. Moreover, the daily increasing means of transport of fodder and grain to feed the cattle and human beings in the famine-stricken areas, have removed many difficulties in the path of the poor agriculturists whose sole need now is the supply of cheap money for the purchase of grain and fodder, which, as a rule, are available "at a price no longer affected by local scarcity but regulated by the market price of the food in the great distributing centres plus the cost of conveyance to the place where the scarcity exists." It is one of the functions of co-operation to enable the agriculturist to secure cheap money by organizing his credit. Mr. H. Dupernex, I. C. S., in his admirable book '*People's Bank for Northern India*" treats of the relation which Co-operative Credit bears to famine. In this connection he observes as follow:—

Now that India possesses every facility of transport and conveyance for moving her food stocks from place to place wherever scarcity exists, famine may be said to have entered on a new phase. The organization of transport is complete, the next step is the organization of credit.

The more a country engages in commerce, the more its wealth accumulates, the better able it is to withstand the shocks of famine. Industrial development is intimately connected with a properly organised system of credit. If it is conceded that famine is to a great extent the result of the dependence of the great mass of the population on agriculture alone, that some of the worst evils of famine may be removed by the establishment of other industries, then the first requisite for attaining the latter desirable object is by fostering the widespread institution of popular banks."

The Indian Famine Commission's Report of 1901 discusses both the curative and protective or preventive measures of famine relief. The third or the last part of this valuable document is devoted to the consideration of protective remedies in the scheme of which a distinct place is assigned to the formation of agricultural banks. The Commissioners say :—

"We attach the highest importance to the establishment of some organization or method whereby cultivators may obtain, without paying usurious rates of interest, and without being given undue facilities for incurring debt, the advances necessary for carrying on their business. Agriculture, like other industries, is supported on credit." The whole of the Section 4th of this Part is devoted to the definition, principles, objects, and the working of these agricultural banks or what we now call Co-operative Credit Societies. In dealing with the comparative merits of State Aid, the Commissioners observe as follows :—

"But even the fuller measure of State Aid in the shape of *takavi* loans, which we shall recommend, will go but a small way towards removing the difficulties of the whole class. Government cannot possibly finance all the cultivators of a district, still less of a province. In the establishment of Mutual Credit Associations lies a large hope for the future of agriculture in India; and from the enquiries we have made there is reason to believe that, if taken up and pressed with patience and energy, such associations may be successfully worked." After dwelling at some length on the details of their working, the Report of the Famine Commission goes on to say :—

"The above is only a brief sketch of the principles, organization and object of village banks founded on the Raiffeisen system. It appears to us that there is in every province, which we have visited, a wide scope for the establishment of such banks? some have been already established in the North-Western Provinces and Oudh. In

some provinces the hope of successful working is better than in others, but everywhere there is justification for an effort. No doubt such banks may, in the commencement, meet with opposition from the money-lender who already occupies the field, and they may also meet with suspicion and half-hearted support from those who do not understand their principles. But Indian native life presents us with instances of co-operation for mutual benefit, and the principle which underlies the Raiffeisen system is not really foreign to the thoughts of the people."

It will be clear from the foregoing paragraphs that eminent advocates of co-operation have shown the potency and efficacy of co-operation as a measure of famine insurance Mr. Dupernex has dealt with the subject at great length and Sir Frederick Nicholson, whose name is very familiar to Indian co-operators by the "Monumental" volumes which embody the results of a most painstaking inquiry and study of the theory and practice of co-operative credit in Europe conducted by him, served on the Famine Commission of 1901 and has fully explained how co-operation prepares cultivators to cope with the famine. Wolff, who is the greatest existing authority on co-operation, while discussing the urgent need of teaching the "debt-burdened" rayats how "certainly to India Co-operative Credit promises to prove a boon" remarks that "in rural districts its need is great rising from time to time to *the point of famine*." Thus the testimony of these three great authorities in co-operative matters is ample in my opinion to convince us of the power and usefulness of linking co-operation to agriculture so as to gradually free the latter by means of the former from the havocs which a year of famine works upon the agriculture of the land.

Granting, therefore, that the organization of co-operative credit is an effective remedy to achieve the object we co-operators have in view, the next question is: Which is the best time to commence that work? Considering the state of ignorance in which we find the vast majority of our masses at the present moment, and considering also their condition of utter dependence upon the village bunniah, the work is bound to be very slow. The popular adage that "Rome was not built in a single day" will literally prove true in this case. The present, however, is the best time to give our thought to this subject, particularly when the famine-striken people have emerged out of their troubles with the lessons of famine quite fresh in their minds. Mr. Dupernex has to make the following recommendation in this connection. He says:—

"But system of credit is not to be created in a day; it requires several years' work to organize on a fitting scale and, if reliance is to be placed on an organized system of credit as a means of combating famine in the future, it should be taken in hand during the seasons of comparative plenty that usually intervene between two famines." Moreover, there is no reason to despair. Mr. Wolff, who is so very searching in his examination of the methods and results of co-operation, speaks in very appreciative terms of the achievements of the first four years' working of these societies in this country (when there were only 2008 societies existing) and expresses not only satisfaction, but even surprise at this great progress made by the co-operative movement in India. He says "That is a record which has no where yet been equalled within the very first stage. The elasticity shown by the co-operative credit presents a striking contrast to the stagnancy displayed by the *takavi* business." Looking however, to the stupendous amount of work that lies before the Indian co-operators we have no reason to feel overjoyed.

At this stage it may be asked that the theory sounds well but has it answered well in practice? To this I reply in the affirmative by taking my stand on the results actually secured both in Western countries and as also in India. Co-operation has proved a veritable blessing both during the period prior to the famine and so also during the period of famine in two different directions. It has increased the staying power of the agriculturists who are the first to fall victims to the evils of famine; and secondly it has enhanced their credit by popularising it. The Report of the proceedings of the English Congress of the International Co-operative Alliance held in 1910 states that by the end of 1908 there were over 91,033 Co-operative Societies in 15 leading countries of Europe. Of these 20 per cent were distributive Societies and nearly 60 per cent must be those that benefitted the agricultural classes in a variety of ways. The figures relating to Germany alone, will be found very interesting. Out of a total of 26,852 Co-operative Societies in Germany in 1908 consisting of a membership of 4,105,602 there are 20,310 Co-operative Societies serving the rural population and bearing the proportion of 75 per cent to the total number. Of these latter 16,092 are Credit Societies with a membership of 22,02,949. Mr. Wolff says that "In Germany alone, in 1908, 919 banks of the Schulze-Delitzsch type only dealt out in advances of various kinds the huge sum of £175,000,000 which has in this way been made to fructify in commerce, industry and agriculture, purchasing raw material and paying wages. The sum lent

out in the same year by about 17,900 Co-operative banks registered in Germany reached altogether the huge figure of nearly £ 240,000,000," which in Indian coin means 360 crores of rupees.

Considering the growth of agricultural co-operation in other countries, it can be easily seen what a gigantic stream of wealth is made to flow into the channel of agricultural development. If one wants to know what the condition of the agriculturists without this side of co-operation had been in these countries, let the pages of German and Italian history dealing with the condition of the peasants in these countries in the early fifties and sixties of the last century be perused and a moment's reflection will convince the reader that co-operation has not only been their salvation but it has proved a real resurrection. As regards India we have the following interesting figures. During the year 1910-11, we had in all 5,432 societies showing an increase of 270 per cent over those of 1905 consisting of 3,14,101 members and with a working capital of Rs. 20,676,993. We in Bombay, however, are very backward having to-day only 368 societies consisting of 29,419 members and with a working capital of Rs. 32,05,911. The rural societies in India number 4,957 with a membership of 2,35,978 and these have a working capital of Rs. 11,018,863. All this money courses into the veins of agricultural occupations followed by the members of these societies and supplies their immediate wants by grant of money at much cheaper rates. To that extent their staying power is improved and their credit has been augmented. Thus, to some extent the position of Indian agriculture is strengthened. Having regard to the needs of our vast cultivating population, though, this is very small relief. Still it is a matter for some satisfaction that a sound beginning has been made in that direction.

So far an attempt is made at showing how co-operative credit can work as a preventive or protective measure of famine insurance. Coming more closely, however, to the time when the cultivators find themselves actually in the midst of a famine it is not difficult to point out how co-operation has stood them in good stead. Mr. Dupernex observes that " The utility of an organized system of popular credit in time of famine is one that has been abundantly demonstrated by the working of the Raiffeisen banks in Germany during a year of scarcity and by that of the popular banks in Italy during times of depression and distress." Here in India, we too have a few telling

instances to prove how members of co-operative credit societies have been enabled by means of their systematised and organized credit to procure cheap money for meeting the needs created by the recent famine or scarcity. Mr. R. B. Ewbank, our present Registar, drew my attention pointedly to the societies of the Gadag Taluka in the District of Dharwar. This Taluka suffered severely from the famine of fodder as did several other districts in Gujarath and in the Deccan. Out of the 33 rural societies in the Dharwar District, 21 Gadag societies have raised altogether Rs. 30,390/- from members, Rs. 22,933/- from non-members, and Rs. 15,000/- from other societies up to March 31, 1912. Besides these loans 13 of these societies were granted a total loan of Rs 59,500 by the Bombay Central Co-operative Society. This brings the total of their loans of Rs. 1,17,823/-. Now I ask would these agriculturists have, during the time of the famine when their credit in the market is very feeble, got such a large and cheap supply of money in such a self-respecting and self-reliant manner if they had not come together and grouped themselves as co-operators? I for one do not think so. Again, in Gujarath some of the rural societies in the three famine-affected districts of Ahmedabad, Kaira, and the Panchmahals on the strength of their co-operative character could get some assistance from the charitable Famine Relief Agencies like the Central Famine Relief Committee and the Wadia Charities in Bombay. Besides the Bombay Central Co-operative Bank granted them loans at 7 per cent for the purchase of hay for their members. The Wadia Charities in recognition of their co-operative basis sold nearly to half a dozen societies grass worth about Rs. 1,000/- at Rs. 8/- per 1,000 lbs. and made a free grant of Rs. 1,200/- to enable small societies, with a portion of this grant as a nucleous to build up a famine fund, and the Central Famine Relief Fund paid them a sum of Rs. 1,000/- to enable them to purchase grass for their members at cheaper rates. Two things stand out boldly. First the principal of self-reliance is gaining a stronger hold on these societies, and secondly, their credit with outside financing agencies is assuredly growing.

A stage has now been reached in the development of Indian co-operation, when agriculturists can be asked to concert measures of direct utility by providing a separate famine fund with their societies as a means of insuring their agriculture against famine. If co-operation is to be true it must teach its votaries the lesson of foresight. In Burma, Cattle Insurance Societies have been a success and there is no reason, therefore, why famine insurance funds to be built by

societies or unions of societies should not be successfully started. If each society, instead of keeping a store of hay in readiness from year to year, makes it a condition that every member will contribute one rupee to form a separate famine fund and if to this fund the society will add 1/10 of its annual profits and invests the same at 5 per cent with the Central Bank to be utilized only during the time of famine, a sufficient amount will be easily available for famine purposes in this way An average society with a membership of 50 and making an annual profit of Rs. 200 will easily have, by this method, in the course of ten years, which is generally considered to be the intervening period between two famines, a sum of Rs. 750/- as a result of co-operation coupled with thrift. Again this readiness and foresight on the part of the members of these societies will enable them to procure sufficient and cheap loans without depending upon the sweet mercies of the village sawcar with whom their individual credit is generally shaken This, in my opinion, is the real solution of the question of famine insurance in favour of agriculture, and co-operation alone will afford the agriculturists the help and the relief which they so sadly need both before and during the period of famine. "To sum up," in the word of Mr. Dupernex, "the relations of credit to famine, we claim first, that with an organized system of credit, the village co-sharer, the better class cultivator, the struggling clerk would all be better able to stand the strain if familiarity with credit institutions had previously taught them the lesson of thrift, and if, when the real pinch came, the doors of such an institution were ready to open for them and provide means for enabling them to tide over the worst till the advent of better days."

A Short Note on Cattle in the Ratnagiri District.

BY

M. N. Padwekar, B. Ag.

THE breed of cattle kept in the Ratnagiri District has many peculiar characters. In general appearance it resembles the breed most commonly employed over the Konkan (*Konkani*) but it is also known as *Burati* (*Khati*) partly owing to the small size of the animals. The bullocks and bull-buffaloes are, as elsewhere, used for ploughs and carts, while the cows and she-buffaloes supply what little milk the people want.

It is difficult to describe the peculiarities of this breed, the small size and the activity of the animals being the features which are usually most noticed by a casual observer. The colour varies, but white is rarely found. The animals are about three feet high and six feet long. They are docile and can be easily broken in to use. The prices vary very much but on an average they are :—

Bullocks	from Rs. 20/-	to Rs. 60/-
Cows	" Rs. 10/-	to Rs. 30/-
Bull-buffaloes	" Rs. 20/-	to Rs. 40/-
Buffaloes	" Rs. 30/-	to Rs. 70/-

The variation of price is mostly due to the form, structure and build of the animal, but depends also upon its docility. In the case of cows and she-buffaloes, milk yield is taken largely into consideration at the time of purchase.

The supply of the animals is limited owing to some extent to the want of fodder and good grazing fields. Some of the poorer cultivators sell the animals to maintain themselves in the hot season and buy them in the monsoon when they borrow money from the money lenders. The animals bought under such circumstances are, of course, usually inferior and can do vary little agricultural work. Bull-buffaloes are not generally bought by the cultivators except by dealers in cattle who are known on this side as *Hedkari* (हेडकरि). They buy the buffaloes for a very small sum and sell them in the higher lands side. The bull-buffaloes though useful in dragging heavy loads require very liberal feeding, which an ordinary cultivator cannot afford to supply. Another use they are put to is at the time of transplanting rice seedlings. There is likelihood, however, that in the near future their use will be much increased as better cultivation than has hitherto been the rule is adopted. Another reason

for the neglect of buffaloes is that they work slowly. The implements at present in use are light and hence a good deal of time and energy are wasted if buffaloes be yoked.

People as a general rule do not import cattle of a better quality as the climate does not suit them. Besides they do not get their natural fodder. Even in this narrow tract four kinds of variation can be marked.

(a) Cattle nurtured on fodder grown on sandy soil.
(b) Cattle nurtured on fodder grown on laterite soil.
(c) Cattle nurtured on fodder grown on black soil (Trap).
(d) Cattle bred in hilly tracts.

The variation is due to the value of the fodder. The fodder grown on black soil is far superior to that on the sandy soil. The cattle bred in the hilly parts of the district are particularly hardy.

There are no special means of breeding cattle. When the cows or buffaloes let out for grazing come in heat they are served by some wandering male of its class and hence the off-spring tends to be inferior. In some places only bulls and bull-buffaloes are kept for breeding purposes and they are allowed to serve any female cattle for a trifling fee which does not ordinarily exceed a rupee. The question of cost is the only matter taken into consideration in nourishing such sires. The expenses of keeping a breeding bull in good condition will appear to be considerable, but I cannot help thinking that the result of doing so will more than compensate for the trouble involved. Another point deserving notice in this connection is the nursing and feeding of the calves. Generally calves are not allowed to suck sufficient milk at the teats of the mother, and hence as they get no other food, the mortality among them is very great. The adequate feeding or nursing of calves is almost entirely neglected. Further, as the male calves grow up, little regulation of breeding from them takes place, and they are not usually castrated until nearly full grown.

There are grazing grounds attached to some villages but the area is not usually sufficient for the village cattle. In villages where such grounds are not available the people send the cattle for grazing in their own fields if possible or in their neighbour's fields on payment of certain fees. The fodder grasses available in the Khed taluka (in which I write) consist of:—

Murga grass, *Durwa*, *Mhatari Undya*, *Kaswin Bhatyan*, *Gonderi Bhatyan i. e.*, *Payan Tikali*, *Mirkat*, *Putni*, *Bardi*, *Argadi*, *Pati* &c.

They are also fed with *Nagli* grain and rice straw and haulms of pulses if possible. Most of the grasses mentioned above are conisdered to have little nutritive value. The supply of better and more nutritive fodder grasses is an urgent need. Silage can be made with much profit as there is a great scarcity of green fodder in the dry season.

In towns it is not possible for any but the wealthy to keep cattle for milking purposes. Whatever milk they want is supplied to them by the inhabitants of villages round about. The milk is usually heavily adulterated with water, but, in spite of this, it is sold at the rate of five to ten seers per rupee, each seer weighing 80 tolas. The milk producer's expenses amount to from four to eight annas per head of cattle.

When the milk given by cows begins to decline, the poor men who cannot conveniently maintain them sell them with the calves at reduced prices which are usually about half of what they would otherwise have fetched. There are a class of dealers who make a speciality of buying such cows. They maintain the cattle till they calve, when they are sold so that they get a profit of about thirty per cent at least, excluding the elder calves, which may be reckoned as profit in addition. They also purchase young calves or weak cattle to which they give proper feed and later on sell at much higher prices. On an average the dealers get more than 20% profit.

The essentials of a good cattle farm are extensive grazing grounds, good water and food supply. The farm must also be at a convenient distance from some big town for procuring the necessary supply. It is very unlikely that such a place can be found in Ratnagiri. In fact, I do not think that this district can ever become a great cattle country. The absence of good grazing grounds in this tract has long been felt. This is partly due to *Khoti* tenure in this district, and consequently in the absence of the provision of public grazing, it seems that even such facilities as in other directions the district possesses cannot be fully utilised.

Sayings and Proverbs on Agriculture Translated from Various Vernaculars.

BY

B. R. Bhadkamkar, B Ag

THE following sayings and proverbs show the overpowering dependence of agriculture on the rainfall and the popular beliefs as to what various natural phenomena foretell in respect to the rainfall and other features of the weather.

1. If clouds with their wealth of waters fail to pour on earth, the plougher's plough and the oxen's sturdy team will be no more.

2. Even Mahadeva (the God Shiva) does not know when it will rain or when child-birth will take place.

3. If the sky fail, the earth will fail and charity too.

4. The crop that is not rained on and the child that does not see its mother's face will not live.

5. Heavy rain is not attended with cold.

6. Rain thrice a month is desirable.

7. A continuous drizzle is preferable to heavy rains at intervals.

8. A drizzling rain brings attack of conductive insect pests.

9. A large halo round the sun foretells rain during the day time and also forebodes famine.

10. If a rainbow appears in the east in the evening or in the west in the morning, it will rain.

11. A red sky in the morning (even in the rainy season) foretells failure of rain.

12. If the morning sky be red, it will rain in the ocean.

13. Red clouds at sunset foretell early rain.

14. The morning cloud, the gathering together of asses, and a southernly breeze in the evening are signs of no rain.

15. If the clouds disperse (in the rainy season) lend your stored seeds at interest.

16. Thunder in the morning, a hot sun at noon, and clouds in the evening are fore-runners of rain.

17. Instant rain follows wind belonging from all sides,

18. Strong wind foretells rain, as excessive familiarity begets enmity.

19. If the south wind blows in the rainy season, sell your bullocks and purchase sheep.

The following few sayings and proverbs indicate the relation between insect pests and rain.

20. A large swarm of white butterflies foretells heavy floods.

21. Rain ceases when winged white ants appear.

22. Excessive rain follows, if white ants take wing in the evening.

23. If ants move to high ground with their eggs rain will follow.

24. If the dragon-fly flies low, it will rain without tail.

25. If mosquitoes be active in the evening, there will be rain.

26. If frogs croak rain will follow.

27. If the crab crawls, the country will flourish.

The following sayings show fore-casts based upon the occurrence of lightning and thunder.

28. The more the lightning, the heavier the rain.

29. A barking dog seldom bites, and a thundering sky seldom rains.

30. Thunder in the hot weather and lightning during the rainy season bring heavy rain.

31. If there be thunder in the rainy season and lightning in the hot weather, there will be no rain.

32. If it rains on a Saturday evening, crops will be free from disease and be fruitful.

The following sayings and proverbs show the necessity and the importance of tillage, manuring, irrigation, and weeding in agriculture.

Tillage.

1. A girl not loved by her husband and a crop on unploughed land are useless.

2. If the soil be ploughed to the consistency of butter, the yield will be a mountain heap.

3. Better plough six times in a hundred days than a hundred times in six days.

4. Ploughing can do what manuring cannot.

5. Defective ploughing cannot be made up by manuring.

6. Sow thick and plough deep.

7. Plough for depth instead of breadth.

8. He will be tired of ploughing who depends upon the dewfall.

9. If soil be allowed to dry after ploughing, the yield of grain will be doubled.

10. Plough with a pointed edge and level with the broad face.

11. Regulate the size of the plough by the strength of your arm and that of the stilts by the length of your legs.

12. Do not plough so as to cut the grass.

13. Wet land ploughed seven times and seed dried seven times can withstand drought for seventy days.

Manuring

14. A field without manure is like a cow without calf.

15. Worshipping God and manuring the field will not be without reward.

16. Relatives will not be as serviceable as manure.

17. Crops without manure are as worthless as a flower without scent.

18. As the rubbish heap rises, the ryot prospers.

19. A field untrodden by sheep and a maid without a husband are of no value.

20. One kind of soil is manure to another.

21. The foot of the sheep is of gold.

Irrigation.

22. Crops without water are just like unoiled hair.

23. Water and a thief should be secured at any cost.

24. *Do not attempt to water a field except by natural flow.*

25. If you take care of the well, the well will take care of your stomach.

26. Sink a well where there is an Ant-hill.

27. In a sandy stratum, the deeper you bore the deeper the water.

28. Though you allow shade, allow no water to stand.

29. It is easier to conduct the duties of a Tahsildar (Mamlatdar) than to distribute water.

Weeding.

30. Hoe your standing crop, rather miss sowing in the season.

31. Manure the field till the crop begins to ear and weed it till the ears are ripened.

32. One who weeds thoroughly has a treasure.

33. Deceitful hearts and fields foul with weeds will never thrive.

34. A field overgrown with *Harali* grass and a man who opposes his king will not thrive.

35. The husband of an unruly wife and he who cultivates a field full of *Harali* grass will be ruined.

36. A house with a harlot and a garden with *Tadana* (a kind of weed) go to ruin.

Further Observations on some Drought Resisting Plants of the Deccan.

BY

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IN the Poona Agricultural College Magazine, Vol. III, No. 3, page 200, preliminary observations on the subject of drought resisting plants in the Deccan were recorded. The plants enumerated there were classified into two sections—Section A-representing such as had commenced to exhibit signs of distress even at the outset of a trying season-Section B-contained those which seemed to fare much better under the same circumstances. Since then, to the time of compiling these results (June 1912) no fewer than twenty-eight to thirty completely dry weeks have passed away. It is simply wonderful how some plants have successfully withstood the ordeal of such a dry season, the plants not having received any hand-watering or any of the recently studied cultural operations for the preservation of water in the soil.

The same limited tract as was mentioned before, was observed in the last week of May and the first half week of June, 1912. The result of the observations is as follows :—

Many plants of the A list, with some exceptions, have completely disappeared, while a greater number of resisting plants appear in B list. The percentage of survivals is twenty and twenty-eight respectively.

I give below detailed notes on each of the plants as recorded in my note-book.

Plants which survived from A list.

(1) *Lagasca mollis.*—This was previously a very stunted plant, only an inch high above ground in some cases and in others the individuals spread on the ground covering it to a distance of nearly five inches all round single plants. The maximum depth to which such plants sent their roots was up to 9½ inches. The leaves were partially curled back.

(2) *Bauhinia tomentosa* (3) *Plumeria acutifolia* (4) *Wrightia tomentosa* (5) *Nyctanthes arbortristis* (6) *Oroxylum indicum*	Strong plants only lived to the end of the season.

(7) *Canna indica.*—Strong plants only lived of the end of the season.

Plants from B list.

(1) *Launea mudicaulis.*—This looked very meagre, leaves spreading, dark coloured, stimulating that of the soil underneath, with white midrib and spinescent margins.

(2) *Phyllanthus madras-patanensis.*—This spread on the ground to a distance of 10 to 12 inches and the main root was as deep as 10½ inches.

(3) *Tridax procumbens.*—This is now a thin and very emaciated plant flowering abundantly.

(4) *Corchorus trilocularis.*—The plants collected are 16 inches high with 3 to 4 branches or stems, having 28 pods. The seeds are ripe. The plant is growing quite well so far.

(5) *Rhyncosia minima.*—A rather weekly plant spreading widely on the ground with no less than nine inflorescences in a stem of scarcely 10 inches long, each inflorescence bearing 3 to 4 ripe pods.

(6) *Tephrosia purpurea.*—This is the only plant which maintained its full greenness and health during this drought and can be depended upon to persist in the worst times, if any material of economic use is derivable from it.

(7) *Dodonea viscosa.*—This is a common hedge plant which also maintained itself through, in some very dry situations, this also had commenced to show distress.

(8)	*Argyrea cuneata.*—	These two, especially the latter are remarkable for retaining vitality in very bad weather.
(9)	*Cryptostegia grandiflora*	

(10) *Guaiacum officinale.*—Remained well in an unwatered but slightly shaded border.

(11) *Ischoemum pilosum.*—(*Kunda*) The portion above ground had all died but the roots underneath were ready to shoot up on the advent of wet weather and so they did in July.

(12) *Andropogon Lawsonii* —This grass retained vitality in the tufts which had become pressed to the ground. This grass can be depended upon to a certain extent to give some cutting helped in its growth by special moisture-retaining culture. Immediately on arrival of the rains it formed a turf.

(13) *Cenchrus biflorus.*–This is another grass which through dying at the top retained vitality in the roots under ground and grew up early in July.

Plant outside list B & A—

(1) *Cocculus villosus.*—This seems a stubborn weed which lived well through the year though it did not develop an extended stem and branch system in exposed situations. It fared well in shade where its branches trailed a long way.

(2) *Abutilon muticum.*—A small plant about 3½ inches high which could be seen on dry land at the time. Many plants of this were perhaps from self-sown seed which had germinated from the little moisture of this year's rabi rainfall.

(3) *Chlotis barbata.*—A grass which formed under ground strong suckers wherein vitality remained, and the plants sprang up immediately on the first appearance of moist weather.

Cottons of Gujarat.

(Continued.)

BY

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Ahmedabad District.

1. *Ahmedabad to Palanpur.* From Ahmedabad to Palanpur the soil is *goradu*. Near Ahmedabad it is very similar to that at Nadiad while further towards Palanpur it becomes more and more sandy.

Cotton is grown up as far north as Sidhpur, the neighbourhood of Ahmedabad growing *Rozi*, and *Lalio*, while Sidhpur grows only *Lalio*. Near Palanpur no cotton is grown, because the land is full of white ants and cotton growing is hence impossible. Round about Ahmedabad a few places have a clay soil, and even a black soil like Surat and Navsari occasionally occurs. (In these areas the types suited to these places appear suitable.)

In the area under discussion, the yield of *Rozi* per acre is about 300 lbs., and that of *Lalio* about 400 lbs.

The land is mostly occupied by *rabi* crops of wheat under irrigation and rape seed and castor without irrigation. The water level is quite near the surface between Ahmedabad and Palanpur, and so does not require a *kos*, and only a *dhekudi* or hand-lift is used. Here the chain pump will do well. The Palanpur neighbourhood requires a *kos* of the Deccan type.

This tract, but for white ants, would have been very useful for tree cotton cultivation, as there is abundance of water. Round about Mehsana the land is of black colour which will suit Navsari-cotton. Rice is taken as a *Kharif* crop in several places where the land is low or by seed making embankments in the less sandy soils.

2. *Ahmedabad to Idaor Road.* The land from Ahmedabad to Idaor Road is *goradu*, becoming more sandy towards Idar.

Lalio cotton is grown from Ahmedabad to Naroda, a distance of ten miles from Ahmedabad, *goradu* while further up there is no cotton of any kind. The cotton is of the same quality as *Baula Lalio* while Navsari can be distributed round about Naroda and Asarva.

The portion towards Prantij near Idar is mostly used for growing *bajri*, *math*, barley and wheat. The yield of cotton per acre here is about 400 lbs. Cotton is not the principal crop of this tract, and is but rarely grown here and there. No definite rotation is, therefore, observed for it though, as a matter of fact, *bajri* is generally rotated.

3 *Dhandhuka* Ranpur is the first place of Dhandhuka Taluka we meet, round which *Mathio* cotton is being grown. It has extended largely within the last three years.

From Ranpur on our way to Dhandhuka, the first thirteen miles, *Wagad* and *Mathio* fields are seen growing side by side, *Mathio* being greater in proportion towards Ranpur and Wagad increasing as we approach the thirteenth mile. After that, the next five miles upto Dhandhuka, pure *Wagad* is grown and round Dhandhuka, within a radius of five miles, only *Wagad* is grown.

Though it is commercially pure still there is a mixture of *Lalio* wherever we see *Wagad* in the Taluka, and that mixture is partly due to the slightly impure seed and is sometimes made intentionally to improve the colour of *Wagad*.

The soil throughout is light coloured "black" like Navsari except some five thousand acres near Dhandhuka on one side where it merges into *goradu*, and is very retentive.

Until the last four years *Mathio* was considered a very heavy yielding variety and hence its larger spread but lately it does not appear to have yielded well ; and so for trial round about Ranpur, people are willing to take small quantities of Navsari seed.

Near Dhandhuka where *Wagad* is grown, *Kahanmi* (Broach Deshi) is not preferred by the people as *Wagad* on the whole gives more lint than *Kahanmi*. Though *Wagad* gives only 33% and *Kahanmi* 35% and though *Kahanmi* lint is valued one rupee more per maund than *Wagad*, yet the total return per acre is greater from *Wagad* than from *Kahanmi*.

Some years ago the seed of *Wagad* from Viramgaon was distributed by the agricultural department in Dhandhuka and the people *there are willing to take that seed from Hirapur* a place near Viramgaon famous for *Wagad*, to sow it in the tract round about Dhandhuka within a radius of five miles. People near Dhandhuka think that round about Dhandhuka *Kahanmi* cotton gives more leaf than *Wagad* but a crop of *Kahanmi* under irrigation, within three miles of Dhandhuka, I found, was very good and had no such fault.

4. *Bhal.* Beyond Dhandhuka commences the tract called Bhal, which includes Dholera and where *Kahanmi* cotton is grown to a larger extent than *Wagad.* As this whole tract is liable to floods the sowing of cotton is done in August and the amount of *Kahanmi* increases, relatively to that of *Wagad* if the rains be good. Here also, light soils are always grown with *Wagad* cotton. I am of opinion that there is considerable opening for the distribution of Broach seed in Bhal, but the quantity of seed in demand, will largely depend on season, as there are neither wells in that Taluka, wherewith irrigation can be done, nor is the soil suitable for irrigation, as both water and soil are liable to be saltish.

But in rare cases under irrigation where water and soil are good, the *Kahanmi* is satisfactory and the staple is equal to that of Surti Broach.

The sample of *Kahanmi* in the neighbourhood of Bhal is very much like the *Lalio* of Banda.

Mathio as a variety of cotton has some special advantages for which its area has been increasing till now.

1. It yields better and earlier.

2. It is picked before the plants suffer from frost as other varieties sown in late season are liable to do.

3. It can be grown where the rainfall is short.

4. It is useful to mix with *Wagad* to improve its colour.

The average yield in a good season of these varieties in pounds is as follows in different parts of the Taluka :—

Variety.	*Taluka.* *Ranpur.*	*Taluka.* *Dhandhuka.*	*Taluka.* *Dholera* or *Bhal.*
Mathio.	500	400	not grown.
Wagad.	300	400	400
Kahanmi.	250	300	400

As most of the Bhal cotton is ginned at Amli, the cotton ginned at this place brings a better price by a rupee over the *Wagad* cotton ginned at Dhandhuka, while the Ranpur gin being a mixture of *Wagad* and *Mathio* is less in value by one Rupee even than that ginned at Dhandhuka.

Kathiawar.

1. *Wadhwan.* This state grows only *Kahanmi* and *Wagad* cottons, as the people are prohibited here from growing *Mathio.* The soil of the

tract is reddish in places with stones at the surface in many fields, while below two feet there is yellow murum and below that white kankar.

This reddish tract grows *Kahanmi* better than *Wagad* as it ripens earlier and thus suits the shallow soil, while a portion of the state that is of black soil, grows *Wagad* better than *Kahanmi*. The yield per acre is 400 lbs. of each variety. Some people prefer *Kahanmi* to *Wagad* for earliness, as it is thus less liable to winter frost and also yields a little better in reddish soil.

The fibre of *Kahanmi* is like that of Broach-Deshi of Broach, while *Wagad* is like the *Wagad* of Viramgaon. Here the water level being nearly 50 feet below the surface, there are very few wells and so no watering is given to cotton. Besides, these wells have not got an abundant supply, even when water is actually reached.

2. *Wakaner.* The tract from Wadhwan to Wakaner is rocky and even grass does not grow well over much of the country. But at Wakaner and round about, there is large cultivation of *bajri*, *jouar* and cotton, the rotation being cotton-*jouar-bajri*. The cotton grown here is mostly *Wagad* and much of it is irrigated like the Bavla cotton. The irrigated crop yields 1000 to 1400 pounds per acre compared with a dry crop of 500 pounds per acre. *Kahanmi* also is grown in lighter soils and it yields better than unirrigated *Wagad* in such soils. It would seem that some portion of the state that is lighter, could be well utilised to grow *Mathio* cotton as that tract being unsuited to *Wagad* or *Kahanmi* does not get the opportunity to grow the paying crop. For the present the state allows only *Kahanmi* and *Wagad* to be grown, the soil is reddish, medium black and *Goradu*. The water level is twenty feet from the surface. Irrigated *Wagad* yields better than irrigated *Kahanmi* and has a better ginning percentage (35-37%). On the Jodhpur side of this state the land is more suited to *Wagad*. The fibre of *Wagad* and *Kahanmi* is very similar to the same varieties grown in Ahmedabad and Broach respectively.

3. *Morvi.* From Wakaner to Morvi the tract is mountainous and the soil is shallow. Though here and there, there is some cultivation of cotton, the crop is poor. This tract, I think, will suit more for *Mathio* than for *Wagad* which is now grown here in some places.

Another portion of Morvi, from Morvi to Jetpur is light black or medium black and here, cotton and Jowar or cotton and Bajri are rotated. The whole state is almost devoid of wells and so the present variety is sown. *Wagad* does not prosper well but remains much

stunted and is also liable to frost. If *Kahanmi* that ripens early here in December-January be sown, it will yield better than a dry crop of *Wagad*. The tract northwards near Vavania is composed more of good black soil and it is good for *Wagad* as this soil can retain moisture better than that near Jetpur.

On the whole, cultivation of *Mathio* and *Kahanmi* will suit better to some tracts of poor and medium nature than the present method of sowing *Wagad* everywhere. The eastern portion near Tankara grows a little *Mathio* but that tract grows very little cotton of any sort. The average yield is 250 to 350 pounds per acre, while there are very few fields yielding more than 400 pounds per acre.

The rotation generally observed is cotton-*jowar*.

4. *Rajkot*. As there is a canal near Rajkot, the cultivation is mostly of irrigated crops such as sugar-cane, wheat &c. but further east there is the cultivation for *Mathio* and *Lalio*, *Mathio* occupying more than three quarters of the cotton area. The soil is medium black nearly two to three feet in depth, while below, there is generally trap rock.

As we go further and further from Rajkot on the southern and western side the land is better. Here *Lalio* was more in cultivation ten years ago but now *Mathio* is being grown more on account of scarcity of rain.

Here on the canal side *Mathio* also is irrigated once or twice and the yield improves by nearly 200 pounds per acre.

The yield of *Mathio* here is 400 pounds per acre, while the yield of *Lalio* in good soils is a little more, say 450 lbs.

The tract where *Lalio* is grown being without the means of irrigation, away from the canal this variety is always grown as a dry crop. The northern portion of the state is mostly rocky and there is very little cultivation.

5. *Jamnagar*. Round about Jamnagar there is no cotton cultivation until we approach Rajkot but the Talukas of the Jamnagar state that are near Gondal are full of cotton cultivation. People here and there near Jamnagar are trying cotton but the yield seems too small to pay. Here *bajri*, *jowar* and wheat are the principal crops. The southern portion of Jamnagar state is in continuation of the northern portion of Rajkot state and so is equally rocky throughout, except some ten miles southwards from Jamnagar.

The cotton that is being grown at Jamgodhapur of this state is *Mathio*. The land is medium black of very little depth here, from six

inches to two feet-and no other better variety will grow here. The crop rotated with cotton is *bajri*.

6 *Gondal*. The northern portion of Gondal almost touches Rajkot while the southern portion comes up to Jetalsar. The chief cotton tract is Jetalsar and Dhoraji where only impure *Mathio* is grown extensively. The land is composed of medium black soil of from six inches to two feet deep. *Bajri* is rotated with cotton and no other better variety can be grown on this soil.

Near Gondal the same cotton is grown with plenty of mixture of *Lalio*.

In the dry area *Mathio* with a slight mixture of *Lalio* is grown, while in irrigated lands there is more of *Lalio* and less of *Mathio* mixed with it. Pure seed of both kinds if grown separately will be better in yield as *Mathio* in the dry area will grow well while *Lalio* in the irrigated area will yield still better. Pure seed of *Mathio* is available near Junagad. The crops rotted in the irrigated area are *bajri* and wheat while in the dry area *bajri* alone.

Near Dhoraji, the cotton grown is the same impure *Mathio*. The land is medium black of from two to three feet deep and is suited for this variety. If there be the means of irrigation *Lalio* under irrigation will grow like Bavla and will yield much better than *Mathio*.

7. *Porbandar*. Porbandar is not a tract of cultivation but of stone. It has got the sea on two sides while the third is of stone. Only one side Porbander to Junagad has got cultivation and nearer to Junagad, cotton is grown.

The tract from Porbander to Ranvav, up to which this spreads in the same direction as the railway, grows *Wagad* cotton here and there. The yield seems moderate. The soil where cotton grows here is medium black while the rest of the country is very stony. *Bajri* or *jowar* are rotated with cotton. The tract on the Junagad side of this state grows cotton of the *Mathio* type and the yield per acre is nearly five hundred pounds.

8. *Junagad*. The tract from Junagad to Veraval is mostly of medium black soil and well suited for cotton except within a few miles round Veraval, which portion being salty is not suited for its cultivation. In this state the light black soil six inches to eighteen inches deep grows *Mathio* cotton of very good quality. It has a fibre better than *Jari* and almost equal to *Bani* in length and feel.

If pure seed of yellow *Mathio* be supplied or selected by the people and ginned on hand gins for seed purposes, the quality will pay for this extra labour.

Portions of the state where the soil is deep grow *Kanci* cotton and that crop also is very good in yield. It has no mixture as the mixture can be easily detected and removed. The tract of Junagad touching Gondal State grows white flowered *Mathio* and that seed is being sown in some light soils in Junagad State in place of yellow flowered *Mathio*. I think this should be stopped as this variety is spoiling the quality of good *Mathio* and it has already spoiled pure *Mathio* by admixture of seed. So yellow *Mathio* for light soils and *Kalanwu* for dry soils will keep up the quality, if the sowing be rotated, on these two kinds of soils, of these two varieties. These will not mix generally as both ripen at different times. The yield per acre of *Mathio* cotton is five to six hundred pounds per acre. *Jowar* and *bajri* are the crops rotated with cotton in alternate years, while where there is well irrigation *Bajri* is followed by wheat and then cotton.

Round about Junagad city, *Mathio* is grown while after some ten miles from Junagad southwards *Kanci* is grown. As we approach Verawal again there is *Mathio* as has already been described.

9. *Dwarka*. From Dwarka to Amreli State the land is sandy loam but is much impregnated with salt and only grows castor, *bajri* and *jowar* and a few other crops. The cotton crop was tried in this tract by the State but it yields not even one hundred pounds per acre. It is peculiar to note that while in the Surat district within a distance of ten miles from the sea, the best cotton is grown, while also in Mr. Molison's book it is also said that the sea breeze tends to bring about a better quality, here the results are quite contrary. Here the soil is six inches to three feet deep, below which there is muram and yellowish or reddish stone. It seems "castor is the best plant for salt land". It is growing here well and in plenty and instead of cotton if the castor silk industry be commenced after it has proved to be profitable, it will be a good business for the people who are almost without any agricultural means to maintain themselves.

10. *Amreli*. The tract from Chital to Amreli and round about Amreli is of light black soil of six to eighteen inches deep, though in some places it is not even three inches deep. This tract grows *Mathio* cotton but the soil being poor, the fibre is shorter than that of the Junagad State. It seems that Broach will not grow here as the soil is

light and the rainfall short, but it seems that if fresh seed of Junagad *Mathio* from near Verawal might be tried it will keep up the quality for some years. Here the yield is four hundred pounds per acre.

The crops rotated are *jowar* and sometime *bajri* with cotton. It seems that *bajri* cotton grown here is growing well and that it is also worth further trials. It was grown on the experimental farm here with good results but with irrigation.

11. *Bhavnagar*. The tract from Chital to Bhavnagar and on the Ghogha side is of light black soil six to twelve inches deep below which there are white or yellowish pieces of stone mixed with a little earth, and further down murum. The cotton grown in the whole State is *Mathio*. *Kanvi*, which was being grown here before the famine of 1896, has almost gone out of existence. The crops rotated with cotton are *bajri* on a large scale and *jowar* in a few places where the soil is sufficiently deep.

This tract also gets about twenty inches of rainfall like Palitana and the same conditions prevail here. The fibre of *Mathio* here is almost like *Khandesh* cotton and in the general crop there is a predominence of white flowers over yellow flowers. The yield per acre is nearly three hundred pounds. It seems that the fibre of Junagad-*Mathio* is the best which as we go from Junagad to Bhavnagar it gradually decreases in length and feel so as to be only equal to *Khandesh* cotton. The same gradual change takes place in the proportion of yellow flowered plants in the crop. The tract from Bhavnagar to Limbdi is of medium black soil and here also *Mathio* is grown but as we approach Limbdi some fields are seen of *Wagad* cotton, some of which are irrigated.

12. *Palitana*. The tract from Songad to Palitana is almost of light soil with six inches depth of earth only below which there is the murum. The tract grows cotton of *Mathio* kind and it seems that no better variety will grow here except *Mathio* of better quality like that from Junagad.

On the State farm different kinds of cotton were grown. Out of which, *Khandesh*, *Mathio*, *Korkeli* and *Buri* are promising and worth trying longer as they have got a kind of superiority over the local, in yield or quality. Here *Khandesh* and *Mathio* are much better than the local, while *Korkeli* and *Buri* though better in quality give a lower yield. *Lalio* grown here does not ripen as the bolls drop down even though watered and hence it does not seem to suit this tract.

The portion of black soil of three feet depth on the Rathanpur side I saw but that also suffers from cold and shortage of rain if *Lalio* be grown, while *Mathio* grows here well. On the whole it seems that this State is suited for *Mathio* and Khandesh and not for cotton of the Broach type. The rainfall here is twenty inches while Kathiawar as a whole has a much smaller rainfall than Gujarat proper. The yield per acre is two to three hundred pounds. The crops rotated with cotton are Bajri and Jowar.

13. *Limbdi to Viramgaon.* From Limbdi to Viramgaon the soil of the tract gradually changes to clay and Limbdi chiefly grows *Wagad* and *Kahanmi* in almost equal proportions.

The rotations usually adopted are like Wadhwan and the whole tract is also similar to Wadhwan. But beyond Wadhwan as far as Viramgaon, the whole portion of somewhat light textured but clayey soil grows only *Wagad* and that also of good quality. The rotations adopted are the same as at Viramgaon. Here the whole crop is taken without watering or irrigation.

Rabies in Horses.

BY

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THIS much dreaded and fatal disease has long been and still remains very common in India among dogs and other domestic animals. It is very probable that the wild jackal is the primary cause of rabies in dogs inasmuch as rabid jackals are often very furious in that state and bite anyone, particularly dogs who are in the habit of night rambling. Man, inoculated with the saliva of a rabid animal soon develops symptoms of hydrophobia and shows a peculiar dread for water a sign which is very characteristic. It is very surprising however that this particular symptom is not at all seen in canines. It is known that rabies affects all animals both wild and tame, and man is no exception.

Recently a horse was brought to the veterinary hospital attached to the agricultural college, showing signs of great nervousness, an inclination to bite the breast and restiveness. His conjunctiva was somewhat injected; he had a slight cough and his temperature was about 102°/ F. He was accordingly given a stimulant expectorant drench.

On the following morning however unmistakable symptoms of rabies suddenly developed; he became very violent and unapproachable, his pupils dilated to a large extent and his eyes had quite a vacant stare in them. In a few minutes he had his breast and off fore cannon all mutilated and torn. His appetite was good and he ate his grain feed as usual and the large quantity of hay that was placed before him he was eating voraciously.

After about an hour and a half to two hours water was shown him when he was suddenly attacked with spasms; he would extend his neck and attempt to drink water but would on no account touch the water or rather as he tried to approach the water he would quickly withdraw again trembling violently as if there was something very dreadful in the water which caused the fright.

This shows that although dogs and similar animals do not as a general rule dread water, still horses show a very marked fear for it as will be seen from the above description. Goats behave in this state as dogs; in a case that came under my notice some years ago, the goat seemed not to care much for its food but would, it appeared, eat earth, filth etc., with relish and when disturbed would at once attack the aggressor with its horns and teeth.

The horse under consideration did not at first bite or kick but later, in the furious stage he would allow nobody, not even his own syce, near him; in fact if any one did venture to approach him he would rush on him and bite him or quickly turn round and kick him.

The animal was then shot under instructions from the Superintendent, Civil Veterinary Department whose advice was asked by the owner, who had himself been injured by biting, and who had to undergo the treatment at the Coonoor Pasteur Institute The brain of the horse was removed and sent to Coonoor for examination; the Director of that Institute in course of time informed us that the horse was truly rabid. Cases of rabid horses are relatively so infrequent that a description of a case which has come so recently under my own notice must have considerable interest.

The Consolidation of Earthen Embankments.

BY

S. S. Godbole, L. C. E.

Assistant Professor of Physics.

IRRIGATION is allied to agriculture so closely that where rainfall is scanty, it may be considered to be the very life of any success in agricultural practice. In such districts, in the absence of irrigation the whole year's work of a farmer is apt, in Western India, to be rendered useless, owing to a failure of the rain. In such a case irrigation is so closely connected with real agricultural success that a few remarks about the construction of works connected with that branch of engineering will, it is hoped, be of use to those interested in Indian cultivation.

A few years ago I was in charge of the construction of a few miles of canal (Godaveri Right Bank Canal) which takes its supply from the river Godaveri in the Nasik district. Here I found that the embankments intended to hold the canal water were consolidated by men with iron rammers nine inches in diameter provided with handles four to five feet long. The consolidation was done with these as the soil was laid in place by the workers. The cost of consolidation came to three annas per 100 cubic feet of soil laid in the bank. However the consolidation done in this way was very poor. An ordinary walking stick could be driven in a thoroughly consolidated bank to a depth of more than two feet. These banks were, moreover, found incapable of holding the canal water without leakage. This was made manifest in places by the subsiding of the banks to a depth of as much as three feet by the rain water which stood against the banks and by the enormous leaking of water which took place. The reasons why the consolidation was not properly done were that the intensity of pressure obtained by the use of rammers was not sufficient to effect the proper consolidation, and secondly the people that were intended for ramming the soil were employed elsewhere by the contractors thus causing much neglect of the consolidation for some hours in a day. To effect proper consolidation it was necessary to get over these two difficulties. The method that was adopted and which proved very successful was to use carts loaded with stones for consolidating the banks. The pressure was transmitted at points where the wheels of the carts were in contact with the banks, the intensity of pressure being sufficient to bring about proper consolidation.

The contractors having no work in which they could employ the carts in any other way had to keep them working on the embankments and the consolidation was thus in progress for the full day. The rate at which the work could be done was one anna nine pies for every 100 cubic feet of earth. One cart was paid at twelve annas per day and this was sufficient for seven hundred cubic feet of earth. The consolidation was perfect. A walking stick could not be driven for more than three to six inches in such a bank. Further it was observed that there was something in the feet of the bullocks which helped the consolidation. For, in a certain place on account of the narrowness of the banks the carts were drawn by men instead of by bullocks and it was found that the consolidation in this case was much inferior. The load that was put in the carts was in the form of rubble. The total weight of the load was adjusted in such a way as to have sufficient pressure for consolidation and to allow the bullocks to move with ease on the loose soil thrown in upon the banks. This weight was four hundred pounds per cart.

Chillies as a Dry Crop.

BY

K. K Bhatarkar.

THE following article gives a short sketch of the method of chillie cultivation practised in a few villages not far to the south of Surat, and is the result of some years' observations on my father's farm. As the cultivation of chillies, as a dry crop, is practised in very few places in Western India, the subject may be found interesting as an account of a novel method of growing the crop.

Before we begin with the subject proper, it is of primary importance to give an account of the special variety grown and a description of the fruits as well as of the plants. The name by which this variety is known in the market of Surat, is *Althani marctan*, Althan being the village where they are produced of the best quality and in the largest amount. The plants belong to a variety of the

species *Capsicum frutescens*. The plants when well grown, attain a height of nearly two and a half feet and when fully branched, cover an area of nearly two feet square. The fruits vary very much in length, the biggest being not more than three inches. The epidermal skin of the fruits or the so-called pericarp, is thin like paper and shines with a peculiar bright lustre. The colour of the fruits is dark red. They rank second in the bazaar for their pungent taste and the easiness with which they are powdered in the monsoon, the first place being given to *larengia marchan* of Poona Kumbharia, near Surat, which belongs to the species *Capsicum minimum*.

The soil on which the variety under discussion is grown is light yellow in colour and termed *gorat* by the cultivators. It is alluvial in character. Limestone nodules are generally found intermixed with fine particles of sand and clay. It is easy for tillage and allows a free drainage of water. The marked peculiarity of the alluvial soils in this neighbourhood—that they do not crack in the hot weather—is shown by those on which these chillies are grown.

The soil is manured every alternate year with farm-yard manure of which nearly twenty cart-loads are spread per acre. It is worthy of note that in addition to this farm-yard manure, a second kind of manure, *i. e.*, castor cake is given every year. The question as to how it is spread will be dealt with in the passage on inter-tillage. After manuring, harrowing begins. Two to three harrowings are given and if the rains come late, even more are required. The soil requires a thorough ploughing before transplantation and therefore two ploughings are given after the first light rains.

The seed bed is prepared in the second week of May. The quantity of seeds required per acre is nearly one pound and a half. The work of growing seedlings, *i. e.*, making beds and watering them when required is generally taken up by the farmers who have got conveniences for growing garden crops. After the first watering, the respective owners cover their beds with leaves of *khajuri*, a variety of the toddy palm. This protects the seedlings from the sun. When the seedlings are two inches high, these leaves are removed and the beds are weeded. The owners weed their beds again and again if required.

After the fall of the first heavy rains, the seedlings are transplanted. The space kept between two plants is two *hats*, a distance equal to nearly twenty-one inches. If the seedlings are big, the tops are cut off. This process of topping the seedlings helps a great deal in bringing about the rapid rooting of the plants, as they are much less

affected by the wind when topped. Twelve to fifteen seed-beds are required for transplanting one acre.

Inter-tillage.—As soon as the first rains have stopped, the process of castor cake manuring is practised. Seven hundred pounds of castor cake manure are given every year per acre. The process of supplying this manure is a curious one. Ten or fifteen days after transplanting, the farmer takes with him labourers and gives them this castor cake powder in baskets. The labourers make a circle round the plant with a *datardi*—a weeding implement by which the roots cannot be injured—and dig the ground. The soil is removed and the manure is thrown in the pit evenly. Next, the pit is again covered. After this manuring, interculture is given and the field is weeded. Three weedings and four intercalturings are generally given. When the plants are flowering, cross ploughing is practised, by which is meant that the land is ploughed from north to south and east to west, forming a sort of rectangle round the plants.

The first picking begins three months from the time of sowing, the average outturn at this time being nearly one hundred pounds. After this, the pickings are carried on at an interval of twenty days. If the chillies are to be picked unripe, nearly five pickings are taken, but if the farmer wishes to take ripe chillies, only two pickings of unripe chillies are taken. The outturn at the second picking is about 700 lbs. Ripe chillies are picked twice, and the interval between the second and the third picking is nearly thirty days which remains the same between the last two pickings. At the time of the last picking, unripe as well as ripe chillies are picked, and the plants dug out and marketed for fuel. The outturn of ripe chillies is 1900 lbs. which when dried weigh 650 lbs. The unripe chillies of the last picking amount to nearly 250 lbs.

Pests and diseases.—The seedlings are generally attacked by broods of caterpillars. Cutworms generally affect the plants when they are freshly planted. Another kind of disease also attacks the plants, affecting the leaves greatly which become folded and drop off, thereby checking the growth and flowering of the plant. Some species of bugs are also found attacking the plants.

In conclusion I venture to give an account of the cost of producing the crop per acre.

Items	Expenditure.			Income.		
	Rs.	A.	P.			
Preparatory charges	3	8	0			
Farm-yard manure 20 carts	15	0	0			
Castor cake manure 700 lbs	15	9	0			
Preparation of seedlings	3	13	0			
Transplanting	2	0	0			
Inter-tillage .	4	8	0			
Picking charges .	8	7	0			
Marketing	1	14	0			
Interest for eight months on Rs 40 ...	1	9	0			
Assessment	7	0	0			
Digging the stems	0	7	0			
Outturn from unripe chillies ..				27	4	0
„ „ dried chillies				81	4	0
„ „ stems				0	12	0
	63	11	0	109	4	0
Net profit Rs. 45-9-0 ...						

Colleges News and Notes.

BEFORE referring to college news, we wish to inform our readers and particularly our students that it has been proposed to open a Correspondence Column in the Magazine. We shall therefore be very glad to receive correspondence, consisting of inquiries or suggestions for improvement in anything connected with the College or Agriculture in general, or with reference to the articles that appear in the Magazine. This column we trust will be a means of giving to the public an opportunity of applying its mind to many a knotty point which often remains unriddled through ignorance of the sources for information. We shall feel much pleased to see our students taking a special interest in this column and making a determined effect to bring difficulties before us or to solve—as far as lies in them—those of others. These questions and answers will be published regularly as far as practicable.

When last we went to the press, we had observed that the College Farm stood bare and bore no signs of that charm and pleasantness which the living plant bestows on it and gratifies man as nothing else does. We are glad that we can record now the solace we received *towards the end of July in the plentiful rain* which dispelled our worst fears. The rains came with a vengeance, as it were, to quench to the full the thirst of the land. There was a constant downpour from the 19th to the 22nd of July, the average during these days being nearly 2 inches with a fall on the farm of 3·41 inches on the 21st. This, we must needs say, *occasioned as much alarm—if not more—as the previous* drought had done. Kirkee was flooded and water to the right of him, water to the left of him water above and below, in front and behind, was the Kirkee resident's lot. The students' quarters near the Kirkee Boat Club appeared to be a launch chartered for an excursion towards the Sangam. But for the timely cessation of the *rains*, the *champion* swimmers of the college would have had a swimming bath in their rooms. The River Sangam reached the highest flood level very close to the springing line of the arches almost endangering the stability of the Wellesley and Railway Bridges and from here onwards the floods caused grave anxiety. The college was closed for the 22nd as it was found in the morning that there was no possible egress for the students staying at Kirkee.

The black soil on the farm was moistened to a depth of 10 inches, and the light soil to 13 inches. Crops could hence be sown at the earliest break. But the break seemed never to come, daily showers on an average of 25 cents causing the soil to keep wet and preventing all field operations. The sowing of crops was begun on the 1st of August a date particularly untimely for *kharif jowar*, cotton etc. But again there was no regular stop in the rains and a strong pour occasionally checked the fieldmen in their work.

With the amount of moisture resulting from 13 inches of rain on the whole, to the end of August, the crops have been thriving very well and the students' eye—eagerly scrutinizing nature's beauties through microscopes and in books during the day—feels relieved at eve in witnessing the farm decked out in a verdant gloss.

This year again is for us a year of deeper study in the problem of the methods and necessity for conservation of moisture For the late rains appear to be very weak and the hot sun since the end of August has been causing the soil to crack. Insect pests are also rife and are doing a great deal of damage. Though precautions are being taken for their destruction the general conditions of the late monsoon and late sowing this year have enabled their rapid spread and made it difficult to combat their attack effectually.

A few showers more would undoubtedly improve the present condition of the farm and crops, but whether we shall get them remains still a question.

On the 18th of July the University Commission composed of Rev. Dr. Mackican, Rev. Fr. Sierp, Dr. Hutchinson, Dr. Mann and Mr. Bhabha, paid a visit of inspection to the college. The Commission was satisfied with everything that Dr. Mann though one of them—had as Principal to show them. They could not have wished, we believe, for anything better than the existing order and arrangement, except that the large lecture-rooms be filled very much more than they are now. In connection with the Commission, Dr. Mann's name in the list is a gem of appreciation for us, though we know that this addition to his duties is a piling, as it were, an Ossa on the Pelion that is already on shoulders in the variety of occupations that take up his time and energy. But from what we have seen and are daily seeing of him, Dr. Mann will match Hercules in his abilities,

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The college students were to make a trip to Lonavla on the 10th of August for the study of rice—transplantation in that tract. An unforeseen accident on the line unfortunately kept them back when they were already at the Poona station very early in the morning. They had to make the best of their disappointment by utilising the contents of their haver-sacks on a picnic party in the station. The S. Ag. students however went some time later with Mr. Kasargode and Mr. Chibber to Khandala to make an out-door study of Entomology and Biology. We regret not to be able to give an account, of their three days' *experiences there, in this number for want of space. It was* the first of its kind undertaken by the students themselves. They must surely have gained very much by it in the hoard of information that the professors gave them in nature's own haunts.

The annual F. Ag. and B. Ag. tours will commence about the middle of October. They have not yet been outlined but will probably cover—with a few exceptions and additions—the same tracts that were visited last year.

We would here like to remind the tourists again to carry their pocket books with them and bring them back filled with observations which will be useful for the Magazine. The editors will be extremely obliged.

Prof. Knight, we are sorry to say, met sometime ago with a bad accident. His horse suddenly contracted symptoms of rabies and before this was known he was inoculated, through a wound on his finger, with the saliva of the animal while drenching it. The horse had to be shot subsequently and Prof. Knight was advised to leave immediately for Connoor for the Pasteur treatment. He was away for a fortnight and though his absence caused some little disorganisation in the usual course of lectures we are glad he was able to leave for the cure before anything serious could happen.

We have an unpleasant prospect before us in the fact that Rao Saheb Kelkar is shortly leaving the college on a year's furlough. All will admit that he well needs a long holiday, yet there's not one that will not regret his departure at a time when we most need him. We wish him, all the same, a very pleasant holiday and a speedy return back to the college. Mr. Ranade, Superintendent of the Dharwar Farm has been appointed to take his place. We can never forget Mr. Ranade's

B. Ag. Students at Horticultural Work
IN THE GANESHKHIND GARDENS

cordial hospitality during our tour to the Dharwar Farm and we have every reason to expect that we shall find in him as good and kind a professor as Rao Saheb Kelkar.

The college hall has during the past quarter been resounding on more than one occasion with the eloquence of the members of the Deccan Agricultural Association. Three meetings were held, at the first of which Prof Burns delivered a lecture on the "Treatment of the Roots of Fruit-Trees" to a fairly large audience. On the 23rd Their Excellencies Sir George and Lady Clarke were present when before a crowded assembly, Sir George delivered his last address at the college. In commending highly the excellent work done by the members of the Association on behalf of the cultivators, His Excellency regretted that his approaching retirement would draw away his personal support from them. "God speed the plough" was His Excellency's final wish, a wish which, we are confident, has ever been very dear to his heart; and for the accomplishment of which he has during his rule in the Presidency done his very best. We wish that Their Excellencies when leaving the shores of India feel happy in the thought of having worked and seen its welfare and we wish also that they may have a safe voyage and a well earned rest at home.

A general meeting of the staff and students was held on the 28th August to select a day for the annual social gathering and to pass the rules of the gymkhana as amended by the subcommittee appointed for the purpose. Mr. S. R. Godbole was elected general secretary and the 22nd of November fixed as the date for the gathering. There was also an interesting discussion on the amended rules before they were passed.

We are sure that our past students will heartily help towards the success of the gathering by their presence and support as far as lies in their power.

In connection with experimental research, Mr. S. S. Godbole is continuing the experiments started by Mr. Butani on the Draught of Ploughs, an article of which appeared in our last number. Mr. Godbole has kindly given us an article for this number and we hope to oblige our readers in course of time with the results of his experiments.

The result of the seed-drill competition cannot be published as it is not yet known. Experiments for testing the drills could not be undertaken till the beginning of August on account of the scarcity of

rain. Various seeds have been sown with each of the drills and we are awaiting the decision of the judges as to which satisfies the specified conditions for the coveted honour. It is highly gratifying indeed that this great prize of Dr. Mann has given an impetus for the exposition of the latent skill and ingenuity of many people in the presidency. And from the variety of drills sent for the competition, we are inclined to believe, that with the aid of enterprising people of means, the manufacture of agricultural implements in India would have a good future

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The first term of the College closed on August 30, and most of the students availed themselves of the fortnight to pay a flying visit to their homes. Dr. Mann too was away during the time, in Bengal, on a visit to the scenes of his early labours in India. He had been to Darjeeling where we hope the cool climate braced him up after the oppressive heat of Poona. The students too, we presume, have had jolly days at their own hearth and home after being liberated from the domineering sway of a relentless cook at the college quarters.

We cannot conclude without referring to the death under tragic circumstances of one of the brightest of our recent graduates, Mr. C. R. Mugali. The sad news which came to us through Mr. Hiremath was one of the most shocking we ever had and it made us cry for vengeance that one of the meekest of our young men should have been brutally done to death in his own house at Hubli in an effort to defend the ladies of his family In him, his family loses a dear and affectionate relative; the Lingayet community, one who gave promises of being an ardent worker for its advancement. His death has caused to us all a wound which we feel will take long to heal. For though, we well know that death is a debt which we are all bound to pay, we cannot reconcile ourselves to the dreadful means by which Mr. Mugali has been snatched away from us. We sympathise most sincerely with Mr. Mugali's relatives and pray that Providence may soothe them in their disconsolate grief. And may. He also rest his soul who staked his life in a noble cause.

The College Gymkhana.

THE cricket season was busy as usual. That there are many enthusiasts for the game—though few only can really handle the willow—was visible in the eagerness with which they tried to find occasionally a hole to creep out of the lectures when an interesting match was being played. Our luck in the Shield Competition Match was exceptionally bad, the Fergusson College completely checkmating us. Mr. Rebello's good bowling was responsible for the larger number of the wickets of our opponents and if only more of our students would display a keen interest in the game we shall have a chance of getting up a good team.

Tennis can never fail to have its patrons. The court is always occupied and it looks likely that there will be a very large number of entries for the competition which is to be held before the Social Gathering. The tournament will probably commence before the tours, as there will be very little time on return to finish them in time before the annual gathering when the champions will have to receive their laurels.

Hockey matches have been played several times in the past quarter. The hockey team has been by far stronger than the cricket team and it has made a very creditable show in all the fixtures. The police team has been very kind in allowing us to practise sometimes on its ground.

The meetings of the Debating Society were held with success during the past term and we had on two occasions the honour of the presidentship of Prof. Dixit of the Fergusson College and Rao Bahadur Godbole. As a result of a discussion during one of the meetings, it was proposed that an attempt should be made to send an Indian manufacturer to Europe to make a study of the European methods for the manufacture of implements. The scheme is a very laudable one and we should be proud to see it succeed.

The programme of the Association for the present term we give below:—

Novemebr	4	Mr. G. G. Pundlik	... Co-operation.
,,	11	Rao Saheb G. K. Kelkar...	A system of cropping.

November	18	Mr. S. B. Raje	... Possibilities of Dairying in India.
,,	25	Mr. V. G. Gokhale	... Fodder supply in the Bombay Presidency.
December	2	Mr. S. K. Mahableshwarkar	... Scientific feeding of cattle.
,,	9	Mr. J. D. Desai	... Relation of commerce to agriculture.
,,	16	Mr. H. B. Rajdev	... Farm life.

NOTICE.

The Fifth Annual Social Gathering of the College takes place on November 22nd 1912. Past students and Well-wishers are requested kindly to give their hearty support. Subscriptions on donations will be very gladly received by the General Secretary,

S. R. GODBOLE.

LIST

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OF THE

Poona Agricultural College.

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Gangadhar Balvant Talvalkar.

1913.

Price As. 9.

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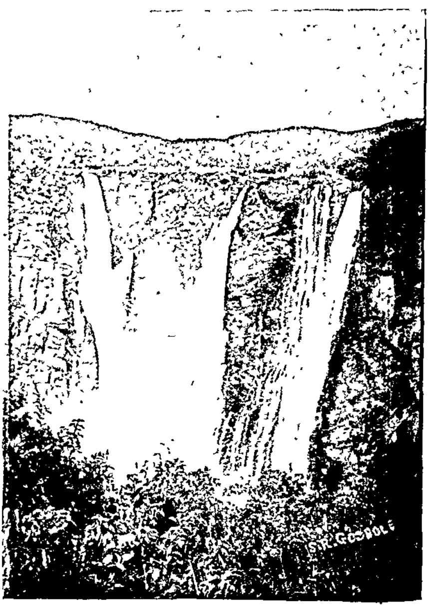

GERSAPPA FALLS.

(View from Mysore Bunglow)

(*B Ag Tour.*)

The Poona Agricultural College Magazine.

Editorial.

IN the eloquent and valuable address which was delivered by Sir Narayan G. Chandavarkar at the recent social gathering at the Poona Agricultural College, he asked the question as to what was the influence of agriculture on the general outlook of an educated man who makes it his life work. Other professions, he said, tend to narrow a man's view, and restrict his sympathy. A lawyer sees so much of quarrelling between people over petty trifles, that the world becomes petty in his eyes. An engineer works among machinery,—and his outlook tends to the idea that the world of mankind is capable of being treated as a piece of machinery. A medical man, even though his outlook is more human, is so accustomed to see people who are sick that his point of view is modified accordingly. Is it the same with agriculture? The speaker thought not,—and conceived that working, as he would do, in the open country in contact with the ever mysterious processes of production and reproduction,—there would be little danger of that narrowness developing which is one of the disquieting features of modern life. The idea is a striking one. Whether Sir Narayan's view is correct depends, of course, on the man. But let us ever conceive that an occupation is a noble one: that we are indeed grubbers in the soil, but that in so doing we are the most valuable citizens of the world that exists, and that it is only by our labours that the world continues to exist at all: and further that we have continually before us, and we continually use and guide for our purposes, those wonderful and mysterious processes of growth and production, before which as yet we can only now bow and confess that their understanding is beyond us.

The present number of the College Magazine contains a number of articles of special interest. We trust, for example, that the report of the competition for a prize of Rs. 500 for a seed drill suitable for our conditions offered by the Principal of the College will stimulate other

to improve on any of those submitted. None of those tested really reached the standard laid down, though several contained ideas of great value. As a supplement to this report, the paper on tests of foreign seed drills on the College farm will be found of great interest.

The tours which all the classes at the College have recently undertaken, and which have been particularly successful this year, form the basis for a number of articles. For the first time in the history of the College, it has been possible to arrange to take the final year student to the spice gardens of Kanara,—which represent some of the most intensive agriculture in Western India. As a result, we present an exceedingly interesting article on these gardens and their special methods The same tour also visited Kathiawar, and some of the notes made on that occasion will also be found of interest and value.

There are a number of other articles which we present with great pleasure, becuse they deal, form personal experience, with problems which are really before our agricultural population daily as real difficulties. The question of the damage of cotton seed during ginning is a matter of urgent importance,—and we owe to Mr. I. S. Kulkarni an account of experiments to determine how for this is affected by the type of gin used. In the Deccan there is no matter more inquired about by the cultivators than the destruction of wild pigs. An account by Mr. Bhandiwad of his efforts in this direction will be of considerable value. The renovation of fruit plantations is a matter of great importance in a district which has been and may be as great a fruit producing centre as the Deccan. Hence, Mr. Patwardhan's straightforward account of how he has dealt with one special case represents just the sort of material which this magazine desires to publish. There are many other articles of equal interest, to which there is no space to refer.

At the recent College social gathering, the project was mooted and discussed, as to whether an agricultural graduates' association should not be formed for mutual assistance and protection, and to form a link with the college in which they have been trained. A most interesting time was spent on that occasion by the large number of graduates of the College who met together, and it is to be hoped that such a graduates' association as that proposed will be a real fact at an early date. There is no feature of an annual social gathering which is more appreciated by the staff and students of the College than the way in which old students gather together on these occasions and resume the interests and nthusiasms of their college days.

As we write the agricultural prospects in Western India are far more satisfactory than at one time seemed likely. The result of the year in Gujarat, the Konkan, and much of the Southern Maratha Country has never been really in doubt. But in the Deccan it was far otherwise, and at the beginning of October it seemed likely that we should be faced with a very severe famine in Ahmednagar, and parts of Poona, Nasik, West Khandesh, and Sholapur. The rain in October, followed by the totally unexpected storms in November 22nd, have largely changed the outlook. *There will still be scarcity,—but the worst we feared will not occur.*

REPORT

On Drills Competiting for Dr. Mann's Prize.

:o:

IN all 8 drills were received for competition from persons mentioned in the following list :—

1.	Messrs. Kirloskar Brothers, Kirloskar Wadi, Dist. Satara.	Four coultered drill.
2.	Mr. G. K. Joshi, Jamkhindi.	Three coultered drill.
3.	Messrs. Kale and Nagarkar, Agricultural College, Poona.	Four coultered drill.
4.	Mr. Madhavrao Deodhar, Baramati, Dist. Poona.	Four coultered drill.
5.	Mr. Harjivan, Carpenter, Surat.	Four coultered drill and two coultered drill.
6.	Mr. Martandrao Mandhre, Loni, Dist. Poona.	Four coultered drill.
7.	Ganesh Kalagriba, Miraj.	Three coultered drill.
8.	Mr. P. R. Joshi, Amraoti.	Three coultered drill.

2. The description of each drill with the detailed construction about the automatic mechanism of each is attached here to as an appendix. The photographs of each of them taken separately are also forwarded herewith.

3. In all five quite distinct principles are represented, Nos. 2, 4, 6 and 7 being a modification of one and the same principle, the other four having each a distinct principle of their own.

4. We will now give our opinion as to how far the several conditions laid down in the advertisement have been fulfilled by each of the various drills :—

1. The exact sale prices of drills Nos. 3, 4, 6 and 8 have not been communicated to us. But we think that they could be made within Rs. 50. Messrs. Kirloskar Brothers gave originally Rs. 55 as the sale price of their drill, but now they inform us that they have been able to offer it at Rs. 45 with some modifications.

2. All drills have attempted this, but the automatic mechanisms require in almost all cases, some modifications to make them more effective.

3. All the drills could only sow Jowar and Bajri. In all cases the gaps have not exceeded 5% except that of Mandhre's. But Messrs. Kirloskar's, Deodhar's and Kale and Nagarkar's have sown bajri much thicker than ordinarily required. As to Jowar Mr. Deodhar's only sow it thicker than required.

4. The Miraj drill, as it stands, is not suitable for sloping land. Messrs. Kale and Nagarkar's will have the same difficulty.

5. To judge this point we have selected four kinds of seeds, namely, bajri, Jowar, cotton and groundnut. But all drills could only deal with bajri and Jowar nearing satisfaction. Joshi of Jamkhindi's, Miraj and Kale and Nagarkar's were able to sow cotton seed but not at all to any satisfaction. The first two of these were able to pass groundnut seed through their hoppers but the dropping was so irregular that it is not worth considering.

6. All the competitors had sent in full sized working models but that of Joshi of Amraoti was too delicate to stand the field trial.

5. A short note giving the obvious merits and defects of each drill separately is given below :—

1. Messrs. Kirloskar Bros. Mostly of cast iron parts, hence not repairable in a village; the springs pulling down the piston not sufficiently strong, hence gaps left heavy in weight and consequently in draft also. Difficult to clean the hopper.

Easy for transport and setting deep or shallow; distance between seed to seed adjustible.

The parts of automatic mechanism not sufficiently strong. Not easy for transport.

2 Mr. Joshi, Jamkhindi. Being mostly made of wooden parts and requiring no chain, easily repairable in a village. Distance between seed to seed adjustible. Also adjustible for size of seed. Contents of hopper easily removed. Seed rate of the same kind of seed adjustible.

3. Messrs. Kale and Nagarkar. No provision to change the distance between seed to seed and for different sizes. This is only possible by changing the cylinders for a different distance or size. The arrangement for mixed sowing provided is defective emptying the cylinder difficult. Unsuitable for sloping land difficult for transport.

Simple in mechanism. Easily reparable by a village carpenter and a tinman.

4. Mr. Deodhar, Baramati. Hoppers leaky. Not easy for transport. No arrangement to throw out of work. Difficult to clean the hopper. No provision to change the distance between seed to seed and for different sized seed.

Simpler in construction and being made of wooden parts excepting the two sproket wheels and chain, is reparable in a village.

5. Mr. Harjivan, Carpenter, Surat. Driving chain gets out of order. *Seeds crushed*, by the pressure of button. The hoppers not having sufficient slope towards the hole, cotton seeds could not be led into the hole. Difficult to transport. No provision to change the distance between seed to seed. Adjustible to different sizes of seeds. Rather simple.

Sowing irregular. The adjustment for cotton and groundnut not effective Emptying the hopper difficult.

6. Mr Mandhre, Loni

The arrangement for throwing out of work impractical. Was received over time. Seed rate adjustible. Easy for transport. Depth adjustible. Entirely made of iron but no castings excepting two gear wheels can be repaired in towns and cities. Durable.

Hopper arrangement defective. Requiring the seed to be kept at almost a constant level, and for this reason some lines remain unsown on sloppy ground. No provision for changing the distance between seed to seed and for size of seeds. Emptying of the hopper difficult. Not easy for transport.

7 Ganesh Kalagriha, Miraj

Simple and compact. Durable parts of automatic mechanism but if broken cannot be repaired in a village.

Could not be worked owing to delicate mechanism. Seems to have possibilities.

8. Mr. Joshi, Amraoti

6. We have put each drill to a careful, thorough and critical test with the exception of No. 8 above, the automatic mechanism of which was too delicate to permit its working on a field scale. All the rest were subjected to a field sowing.

To arrive at an accurate comparison of the several drills we made a list of all the requisite points that should be in an ideal drill under two heads major and minor. The capability of each drill as observed from a careful examination of the various mechanism, independently and in consultation with the makers and further tested by field trials, for each point, has been marked. The statement giving these details is given below :—

Considering on the whole, there is not a single drill which reaches even approximately the required standard of completeness. In assigning marks therefore to each drill we have taken into consideration to how many points, the maker has given thought and to what extent his ideas are put into practice.

Points considered.	Full Marks.	Kirloskar. 1	Joshi of Jamkhind 2	Kale and Nagarkar 3	Deodhar. 4	Harjivan. 5	Mandhre. 6	Ganesh Kala Griha. 7	Joshi of Amraoti. 8
Major.									
1. Principle of automatism.	100	50	50	60	50	35	55	50	75
2 Regulation of distance between seed to seed in a row	100	100	100	25	25	25	60	35	25
3. Uniform dropping ...	100	50	85	85	70	65	55	85	0
4. Suitability to different sized seeds	75	20	50	20	20	60	40	40	20
5. Regulation of depth ...	50	40	15	10	10	15	35	15	10
6 Maximum and minimum number of seeds in a place	50	10	35	30	25	35	30	30	0
7. Regulation of seed-rate	50	30	25	10	10	25	20	10	10
Total Major...	525	300	360	240	210	260	295	265	140
Minor									
1. Simplicity	25	5	15	15	15	10	10	18	15
2. Durability	25	20	10	7	10	10	17	12	5
3. Arrangement to throw out of work	20	20	15	0	0	8	5	0	0
4. Facility for transport ...	15	15	0	0	0	0	15	5	10
5. Regulation of distance between two rows ..	15	15	0	0	0	5	10	0	0
6. Minimum quantity of seed that can be sown ...	15	15	15	10	15	15	15	0	15
7. Arrangement for emptying the hopper	15	3	12	1	3	3	5	2	8
8. Arrangement to sow mixtures...	10	10	0	0	0	0	0	0	0
9. Working in uneven soil.	10	*10*	*10*	*5*	*10*	*10*	*10*	*3*	*10*
10. Scraper arrangement ...	10	10	0	0	0	10	0	10	0
11. Covering arrangement.	10	10	0	0	0	0	0	10	0
12. Arrangement to see whether the seed is dropping	5	0	0	0	0	0	0	0	0
Total Minor...	175	133	77	38	53	71	87	60	63
Grand Total...	700	433	437	278	263	331	382	325	203

7. From the statement it will be seen that we have allotted in all 700 marks out of which 525 are for major points, and 175 for minor. The various drills stand in the following order of merit :—

Rank and Name of the Competitor.	Major.	Minor.	Total.
I (2) Mr. Joshi of Jamkhindi ...	360	77	437
II (1) *Messrs. Kirloskar Bros.* ...	300	133	433
III (6) Mr. Mandhre, Loni ...	295	87	382
IV (5) Mr. Harjivan, Surat ...	260	71	331
V (7) Ganesh Kala Griha, Miraj ...	265	60	325
VI (3) Messrs. Kale and Nagarkar.	240	38	278
VII (4) Mr. Deodhar, Baramati ...	210	53	263
VIII (8) *Mr. Joshi, Amraoti* ...	140*	63	203

* Certain points of these could not be tested in the field owing to unworkable mechanism.

Note :—In the above marking we have not made any disallowance for Mr. Mandhre's drill for submitting it much later than the last prescribed date. Further we understand that he was allowed to see the other competition drills before submission of his model.

On a careful consideration, we have come to a conclusion that no one drill is so superior to others as to carry away the full amount of the prize, in exclusion of others

Each and every one has shown some ingenious originality and deserves appreciation. We therefore recommend that the prize be divided. We might propose, for this purpose, that all the first seven receive Rs. 40 each, and the remaining Rs. 220 be distributed amongst the first five according to their order of merit in the scale prescribed in *the following table*:—

Rank and Name of the Competitor.	General.	Special.	Total.
I *Mr. Joshi, Jamkhindi* ...	40	90	130
II Messrs. Kirloskar Brothers ...	40	65	105
III Mr. Mandhre, Loni	40	40	80
IV Mr. Harjivan, Surat	40	15	55
V Ganesh Kala Griha, Miraj ...	40	10	50
VI Messrs. Kale and Nagarkar ...	40	.	40
VII Mr. Deodhar, Baramati ..	40	...	40
VIII Mr. Joshi, Amraoti	...	...	...
Total...	280	220	500

Considering all the points, none of the drills as presented in the model is in a suitable form for immediate adoption, as they stand. This much is certain, however, that very good ideas have been brought forward, and *from a combination of the good points of each it is possible* to work out each of the principles represented to an *efficiency required* for our conditions.

* * * *

Seed Drill Presented by

Messrs Kirloskar Bros,

Kirloskar Wadi, Dist. Satara.

This is a *four coultered* drill made entirely of iron parts except the pole. This consists in two side wheels 14 inches in diameter joined by an axle.

Behind this axle and *running parallel to it is a round iron* bar joined to the former by elbow at both the ends. To the front portion of this elbow is bolted a countorpoise weight and to the rear the wheel scrapers.

The rear bar carries the coulters; to the rear end of these coulters is bolted the automatic sowing attachment and the hopper.

On the same bar are fitted two cast iron supports, for bolting the draft poles. *The inside edge of this casting* has *four notches, which* receive the tooth of the levers. The angle of the coulters can be made *more or less acute thus allowing deep or shallow setting or even* throwing them off the ground altogether when required. These levers are fixed *to the handles which are placed inside and just close to the* notched casting.

The automatic sowing apparatus consists of two supports starting from the rear end of the coulter and slanting forward and upwards. The rear end of these supports carries a tongue on the underside, of which there is a small roller rigidly connected to it but having free movement on its axis.

At the top *of the* supports is a case which is pierced through by a pointed piston and which has a grooved receiver at the top. On the axle of the wheels, *for* each coulter is provided a set of toothed wheels, the teeth on different wheels in each set varying from 3 to 8. Any of

these can be fixed rigidly to the axle just below the tongue which is pushed upwards, whenever one of the teeth comes exactly below the roller of the tongue, in the process of revolution.

The piston which has been referred to above, normally rests on the tongue and is pushed upwards by the upward movement of the latter. The piston when once lifted, is brought down by a spring if not so done by its own weight.

The piston when pushed protrudes in the groove referred to above and lifts up and delivers into the tubes, the seeds which have run down in the groove from the hopper.

The distance between the rows is adjustable by movable coulters. Arrangement for mixed sowing is provided.

The machine is of cast iron and strong but heavy. It is easy to transport

This drill carries an attachment for covering the seed after sowing.

* * * *

Seed Drill Presented by

Mr. Joshi, Jamkhindi.

This consists of an ordinary three coultered seed-drill usually used for sowing Jowar in that tract, and an automatic sowing mechanism as described below .—

The horizontal motion of the bullocks while walking is transmitted into circular motion by means of one central wooden wheel 12 inches in diameter, and rolling on the ground. It is fixed to the draft pole by means of two iron standards working on a hinge with the draft pole. On one end of the axle of this wheel there is another wooden pulley of 2" diameter.

Over the tubes is erected a platform which is supported by two upright supports on the two ends of the head-piece. On this platform over each tube, is fixed a small rectangular wooden case. Through the centre of these passes a square shaft. Three wooden pulleys of 4", 6", and 8" diameters are fixed on this shaft close to the central case. A rope passes over the small pulley and one of these according as the distance between two seeds in a row is required. This rope also passes over a third pulley which is fixed in two perpendicular iron supports three feet over the transmission wheel.

In each of the three wooden cases a wooden roller one inch in diameter and 1½ inches long and having two circles of 12 depressions, each of which on one alternates with one on the other.

Regulation of the seed-rate :—This is effected by a wooden pin passing through the side of each case and can be pushed in just above the roller. More the length of the roller exposed to the flow of the seed from the hopper, more seed or bigger size will be sown The pin by pushing out or in can be made to cover more or less length of the roller.

In front of the cases there is a screw which presses on a spring inside the case and can widen or narrow down the opening over the roller, thus allowing the feeding of bigger or smaller sized seeds. The machine can be thrown out of work when desired by lifting the transmission wheel off the ground by means of ropes.

Regulation of distance between two adjacent seeds in a row :—This can be done by shifting the rope on one of the three wooden wheels, or covering or keeping open both the series of holes on the inside roller.

The contrivance has been put into practice in a very simple and ingenious manner and consists of parts which are easily procurable and repairable. The construction as made is however kacha and rickety.

* * * *

Seed Drill Presented by

Messrs. Kale and Nagarkar,

Agricultural College, Poona.

This consists in the following automatic sowing arrangement attached to an ordinary local four coultered drill.

To the head piece are nailed two iron strips, one at each end, and projecting forward. The forward ends are curved into a loop through which passes an axle, carrying two wooden wheels 16″ in diameter one at each end.

This axle passes through a galvanised iron sheet cylinder 5″ in diameter and carries a fan of the same material, which revolves inside and flush to the sides of the cylinder. The cylinder has 4 circles of equidistant holes, the distance between each two circles being the same as the distance between each two articles being the same as the distance

between the two coulters. (The cylinder has a compartment for sowing a mixed crop like tur.) But this will not do the mixed cropping as required in practice.

By the walking of the bullocks the wheels turn on the ground and revolve the axle, as well as the fan and the cylinder on it. When each hole on the cylinder, comes at the lowest position it drops through it the seeds from the cylinder. The seeds are then caught by funnels placed just below the cylinder and are carried by short tubes through the coulters into the ground.

* * * *

Seed Drill Presented by

Mr. Deodhar, Baramati,

Dist. Poona.

This consists in the following automatic sowing arrangement attached to an ordinary four coultered seed-drill.

At the two ends of the head piece are mortised two cross wooden pieces projecting about 15″ forward from the head piece; through these, 8 inches in front of the head piece passes a round iron axle carrying at both the ends outside the pieces two wooden wheels 18″ in diameter and protected by iron tyres. These wheels, when the drill is at work roll on the ground.

The two end pieces above referred to also carry two vertical supports 2′ tall. Inside the top of these supports is bolted on a deal wood box divided into four compartments wide at the top so sloping inwards at the bottom as to leave a narrow slit in the bottom. Each slit comes over the bamboo tubes fitted vertically in the coulters.

There is another axle with its ends inserted in the vertical supports just below the box. This axle carries four wooden disks having on its circumference nine equidistant pits. These disks are so fixed that they will revolve in the slit at the bottom of each compartment. The portion of disks exposed below the box is encased by a tin case opening below into the bamboo tubes.

Each of the two axles described above carries in its respective centre a gear wheel of the same size over which passes a chain.

When the drill is in motion the land wheels turn round and thus make the sowing disks to revolve which in their process of revolution pick up seeds from the hopper and feed them at regular intervals into the tubes.

* * * *

Seed-Drill Presented by

Mr. Harjiwan, Carpenter,

Surat.

This consists of a rectangular wooden frame below the back end of which are fixed coulters like an ordinary drill 1' apart.

The automatic mechanism consists of the following :—

The frame is mounted on the axle of two wooden side wheels 18" in diameter. This axle carries between the left wheel and frame a cycle gearing. The frame carries a seed box on two supports 21" tall containing four compartments. On the top of the two supports and inside the seed box is placed a square shaft which carries outside the case on the left end one small gearing.

A chain passes over this small wheel and the one mentioned above. Thus a revolving motion is created by the landwheels and transmitted to the shaft inside the box.

The square shaft passes through four wooden wheels one in each compartment and having 6 wooden teeth on each. The centre of each compartment has a hole at the bottom which is kept closed by a button connected to a spring and which is opened by a push of the teeth on to the spring in the process of revolution.

The seeds dropped though these holes are received by a funnel into iron tubes which carry it into the soil through the coulters as in an ordinary drill.

Regulation of distance between seed to seed in a row :—adjusted by putting in tin plates having different sized holes according to the size or grain or seed-rate to be sown under the central hole in each compartment.

While at work seeds were being crushed under the button at each stroke.

The Coultered Seed-Drill.

The construction and the sowing arrangement are the same as in the four coultered drill, except that there is provision for giving three distances between the two adjacent rows.

Seed Drill Presented by

Mr. Martandrao Mandhré, Loni,

District Poona.

This Four Coultered drill, which is wholly made of iron consists of an angle iron frame mounted on the axle of two side wheels 12 inches in diameter and a third wheel in front On the left end of the axle of the two side wheels and outside the wheel on that side is fixed a small bicycle gear wheel.

On the main frame, just over the axle, are revetted double upright supports 20 inches tall. To the top of these supports is bolted a Sheet-iron box.

About 4 inches below this box, is a square bar inserted and turning into bearings in the upright supports. To the left end of this is fitted a bigger gear wheel being the mate to the cogwheel at one end of the axle of the side wheels mentioned above. A bicycle chain passes over these two,and transmits the motion of the side wheels to the upper axle.

The upper bar passes through four wooden rollers 3" diameter, having on their circumference two circles of groves and two circles of equidistant pits. These rollers are encased in closely fitting iron cylinders, each of which has one hole at the bottom and another hole at the top the latter being connected with the seed in the box by a funnel. The iron cylinder has also a hole at the back which is always shut by a button kept pressed on it by a spring, but which can be opened when required.

Between the two lower ends of the upright supports is carried another iron bar on which are bolted four wrought iron coulters in two pieces hinged together This bar has a series of holes so that the coulters can be fixed at varying distances. The forward portion of the coulter has a long hook which can be latched behind and made to raise the coulters off from the ground when necessary. The rear half of the coulter has also holes, which enable them being set on the bar forward or behind so as to make their penetration shallow or deep.

In the holes bored in the front half of the coulters are set iron tubes slanting behind and resting on a cross bar fixed about the middle of the upright supports. These tubes carry on their top funnels which receive and feed into the tubes the seed as it falls from the cylinder.

The bottom of the box has 1' square holes one over each of the cylinders. On these holes slides an iron strip having four square holes of the same size and at the same distance as those in the bottom of the box. The feeding area can be regulated or altogether closed by sliding this strip in or out.

The rollers can be drawn in or out so as to bring the desired groove or the line of pits under the feeding hole as required by the size of the seed and either billing or drilling. The hole at the back of the cylinder enables examining whether the desired groove or line of pits has been set exactly under the feeding hole.

To the rear end of the frame are fixed two handles to guide and steady the implement.

This machine is strong, durable and light and very easy to transport.

*   *   *   *

Seed-Drill Presented by

Ganesh Kala Griha, Miraj

This is a three couitered drill with the following automatic arrangement :—

On the head piece of the drill two supports 15' tall are erected which carry on their top a board on which is bolted on a hopper. The hopper is pierced through the sides by an iron axle which carries, inside the hopper, three cast iron grooved pulleys. On one end of the axle outside the hopper is fixed a gear wheel. From both ends of the same axle also outside the hopper are hung two iron strips, which at the lower ends are pierced through by another axle carrying a wooden roller 8" in diameter and 5½ inches wide and a gear wheel on one side and of the same size as the one mentioned above.

Over the two gears—one on the side of the roller and the other on the side of the hopper-passes a chain.

The wooden roller when at work rolls on the ground and thus make the grooved pulleys inside the hopper to revolve. The hopper has three holes in its bottom through which rise three sheet-iron tubes in front of the pulleys. The pulleys have on their circumference four quidistant pits, which, when the drill is at work, revolve, pick up the eeds from the hopper and feed the tubes in front, regularly.

Seed-Drill Presented by

Mr. P R. Joshi, Amraoti.

This consists in an ordinary three conltered drill having the coulters 1 foot apart, with an automatic sowing arrangement as described below.

A wheel 1 foot in diameter is fixed on the underside of the draft pole 2 feet forward from the head piece of the drill. The vertical motion of this wheel is charged into horizontally semi-circular motion by an eccentric arrangement, which moves in a hopper, a circular iron plate, having 12 holes

The bottom of the hopper has got three equidistant holes below each of which there is a sheet-iron tubing which connects with the bamboo tubes.

In the process of movement, when the holes of the two plates correspond the seeds drop down and enter the tubes through which they fall into the soil as usual.

Model submitted drops seed every three inches in the row.

The draft pole is cut into two and joined again by a hinge so that he height of the bullocks and distance of yoking may not lift the wheel toff from the ground

The principle on which this drill is devised, appears very good, and worth working out but the parts used in the Model are very weak and i could never be worked satisfactorily.

Tests of Foreign Seed-Drills

ON

The Agricultural College Farm

BY

V. G. Gokhale, L. Ag.,

Superintendent Agricultural College Farm.

—— :o: ——

[During the season of 1912 a considerable number of seed-drills from various countries and manufactures have been collected in the agricultural college farm, and tests have consequently been made to ascertain how far these are better than those locally used, and how they compare among themselves. The following report, prepared by Mr. Gokhale on the subject, and submitted to professor Knight, will be found of great interest. Ed.]

The following 7 drills were tried .—

1. Rudsack Disk Drill.
2. Rudsack Coulter Drill.
3. Keystone Disk Drill.
4. Clipper 5 Hoed Drill.
5. Climax Corn planter single row.
6. Single row corn planter having three series of teeth on driving wheel, and,
7. Poona local Kharif drill for comparison.

All these were worked on 22nd August 1912 when the land was accessible, and had sufficient moisture. The soil was prepared into a very good seed bed.

I enclose herewith a statement, embodying the results of tests taken with the various drills on the points noted therein.

My experience, and observations of these drills and their working, and my interpretation of the results of tests obtained, as recorded in the statement might be summarised as follows :—

Suitability to different sized seeds :—All drills except Nos. 5 and 6 could be made to sow all sizes of grains upto and including maize. The sowing of groundnut was not however satisfactory in any, even with the smaller varieties far less with bigger ones.

Nos. 5 and 6 having no adjustment, sowed smaller sized grains like Bajri and Jowars too thick. But it would not be difficult to get the necessary modifications made here. Groundnut seed was crushed owing to insufficient depth of the hole in the plate.

Percentage of misses or un-sown land :—In this respect the corn planters are ideal for all grains that can pass through the holes in the plate. The rest have sown the smaller sizes without any material skips. In the case of Keystone and Clipper the percentage has been insignificant as compared to the German drills. But it is believed, that if the German drills might have been set as thick in the row as the above two the percentage would have been reduced to the same. The gaps, in the case of bigger sized seeds—cotton, maize and groundnut,—have been many ; but letting a thicker seed-rate and keeping a larger quantity of seed in the hopper, would, it is believed, diminish them a good deal. As regards cotton the ordinary pasting with cow dung and mud is not sufficient but it is essential that the seeds must be pasted hard and thoroughly dry, so that they will never clog together under the revolving pressure of the feeding wheels. Pasting with wheat flour was not found sufficiently effective. This had again to be pasted by a thick paste of sticky-clay.

Average distance from seed to seed in a row obtained during regular delivery :—In the case of corn planters the dropping was regular at set distances, but in case of small seed-Bajri and Jowar through a maize hole-many seeds dropping through the big hole, spread over a distance of 9 to 12 inches at each hill in a line.

For other, at each feeding 2 to 5 seeds or more were fed each time, while either distributed in two or three equidistant places over the entire set distance, or over a continuous line when the seed-rate was thicker.

Adjustibility to varying distances between the adjacent rows :—This is practicable to almost any distance in German drills by shifting the position of the coulters and closing the unnecessary feeding wheels. It

is also possible to a considerable degree in the 'Clipper'. In the single row corn planters, it is perfect as it only sows one row at a time.

Draft:— The draft in the bigger drills is about twice as much as in the local one, thus requiring two pairs ; that in the Clipper drill is nearly the same as the local drill. The corn-planters were of course the lightest in draft having sown only one row at a time.

Maximum depth penetrated:— In this respect the Rudsack coulter comes the last, but not so bad as it appears, on thoroughly prepared soil. The Clipper is better than Keystone.

Special points of each —The Corn planter system of delivery will have no skip and dropping will be perfectly regular. These are adjustable for distance between seed to seed in a row. The machines are simple and handy.

The German drills have provision for a variable distance between seed to seed in a row and the seed can be made to drop from below or above according to the size, it being always possible to sow the larger sized seeds from above. These are also easy to empty the contents of the hopper.

Clipper drill, considering its simplicity and size have more adjustments, and is cheap and easily drawn by one pair.

Conclusions.— In the first instance it is clearly brought out how defective the local seed drill, is, the percentage of skips, by the best on this farm being 30 and over for all sizes of seeds except jowar when also it nearly approaches 25 per cent.

I am of opinion, that Five-hoed Clipper drill suits the Indian conditions more than any one else. The adjustment for variable distance between seed to seed in a row can also be done at a very little extra cost, as I have already succeeded in doing so on the farm drill.

The principle of the Corn-planter is of course the most desirable, provided it is combined into a three-rowed one, which I have ideas is not impracticable to make.

Name of the drill		Total length sown in feet					Distance in the rows at which the drill is made or set to sow.	Percentage of unsown land					Bajri.			Jow.
		Bajri.	Jowar.	Maize.	Cotton.	Groundnut		Bajri.	Jowar.	Maize	Cotton.	Groundnut	How set.	Actual quantity sown	quantity per mile length.	How set.
Rudsack Disk drill.	From above ..	450	492	474	312	408	15 '	8	5 5	23 7	19 0	56 5	2 Division on scale	0–2	0–11½	Divi. 3½
	From below ...	462	414	444	284	480	18 '	3 4	16 8	23 4	52·4	63 9	Do	Do	Do	
Rudsack Coulter drill	From above ..	412½	360	385	222	375	12½"	3 1	12 8	45 2	44 6	40·8	2½ Divisions	0–2	0–13½	Divi 3½
	From below ..	375	382½	360	195	365	15"	4 3	9 0	12 8	57 4	62 8	Do.	Do	Do	1½ Times the size of jowar
Keystone Drill	..	1277 1125	1760	1440	1694	1530	13"	6 8 1 3	12 1	14 3	24 9	58 6	to allow 1½ Thickness	0 6	1 8½	
Clipper Drill	...	1200	800	468	495	805	10"	1·6	1 2	27 2	91 3	68 3	7 Bg. ½ on Wheel scale.	0–10	3–8	At 1½ for wheat.

Uliman ... corn-planter ...	165	165	165	165	165	26″	0	0	1 7 (One of the two lines was without a miss)		46 3	Maize pulse	0–6	12–0	Maize pulse
Corn-planter wiht 3 series of teeth on the driving wheel.	165	165	165	165	165	21½″	0	0	6·4 (One of two lines was without a miss)	4 2	57 0	Do	0–3	6 3	Do
Poona Local Kharif Drill. ...	660	660	660	660	193 5	6″ 12 No setting possible but this is the desired one by the sower.	31·0	18 8	36 3	66 8	57 9	Usual	0–2	1–0	usual

ear.		Maize.			Cotton.			Groundnut			Maximum depth that can be obtained.	Draft			cost	
												No. of Coulters drawing the soil.	Power.			
Actual quantity sown.	quantity per mile.	How set.	Actual quantity	Quantity per mile	How set.	Actual quantity.	Quantity per mile	How set.	Actual quantity.	Quantity per mile.			Maximum	average.		
													Cwt.	Cwt	Rs.	
0-2	0–11¼	9 Div.	0–6	2–2¼	11 Div.	0–4	2–3¼	...	0–12	1–8	Inches not available	12	4¾	3½	425	Cotton seed was clogged up together especially when being sown below so requires thoroughly separate seeds and up to dry groundnuts feeding from below was not satisfactory adjustable distance between seed to seed in a row.
0-2	0–11¼	9 Div.	0–5	2–3½	9 Div.	0–2	1–0¼	...	Not available.	...	2½"	13	3¼	2¼	300	
0-6	1–2	Was set very thick.	2–0	7–6	So as to allow 1½ thickness of cotton	1–3	3–0	So as to allow 1½ thickness of groundnut.	1–8	5–0	3" to 3¼"	12	4½	3¼	175	Drier seed in case of cotton was available.

0–6	2–7½	1 for wheat.	0–5	5–8	¾ for wheat	0–2	1–5¼		0–14	5–11	3" to 4	5	2¼	2	35	Requires thoroughly cemented and dry seed otherwise gets clogged and seeding is quite irregular.
0–4	8–0	Set for maize.	0–3	6–0	Maize plate.	0–3	6–0		0–2	4–0	3½ to 4	1	1½	1½	25	Much of the seed is split up as the [illegible] plate cover were intended for Maize [illegible] thinner seed than groundnut
...	...	Do.	0–3	6–0	Maize plate.	0–2	4–0		0–2	4–0	3½ to 4	1	1⅞	1⅜	25	Do.
0–4	2–0	Usual.	0–4	2–0	Usual.	0–4	2–0		0–4	3–3½	3 to 4" The lesser depth being attained on hard and insufficiently tilled soil.	4	2⅜	2	5	

The Economic Water Plants of the Bombay Presidency.

BY

H. M Chibber, M. A.

(Continued from the July number of 1912.)

:o:

THE water plants treated in the July number of this Journal were such as yielded food for human consumption. Those that I am dealing with in this number yield other products. Before doing so, I would supplement the information regarding the practice of planting *Shingada* (*Trapa bispinosa*) followed in this Presidency.

At Dohad in the Panch Mahal District, the planter, who is a *Bhoi* by caste takes three or four vines by the lower end, and gives them a simple knot there. He thus prepares all the vines to be planted into bunches of three or four. He takes them into water over a float of any sort (generally a log of wood hollowed out). He stands in the waters that are about three or four feet deep holds a bunch of the vines between the fingers and toe of his foot by the knot and presses it in the mud at the bottom of the tank If the length of the vines permits it, after two or three days, he presses down into the mud one or two feet of the vines just over the knot in a horizontal position. The distance maintained between the different bunches is about five feet either way.

At Nadiad in the Kaira District the above process is modified as below. The lower ends of three or four vines are taken and are secured to a peg of wood by a grass rope. The peg is about a foot in length, pointed at the lower end and provided with a sort of groove near the upper end. The rope is tied to the vines about a foot from the end. The rope is then plaited with the foot-length left for the purpose and its free end is tied to the peg. The planter enters the tank with the bunches held by the pegs. He dives if necessary and drives the pegs into the mud at the bottom of the tank. No further pressing of the vines subsequent to planting is practised. The planting-distance is the same as at Dohad.

POTAMOGETON PERFOLIATUS.

Aeschynomene aspera L.—This is an annual, growing in the rains on the margins of tanks. It grows wild throughout the Presidency. The writer is not aware of its being cultivated anywhere. It is a plant of the Leguminous order. It is its stem that has an economic value. The lower part about a foot or two in length is swollen with soft pith-like substance containing air. To the plant this tissue probably serves the purpose of facilitating respiration of the roots that are submerged under water or wet mud. To men this spongy material is serviceable in a variety of ways. It is used in the manufacture of the sola *Topi* which is worn by people to protect themselves against the sun. A more artistic production takes the form of *Bashing*, a kind of wedding crown worn on the marriage day among certain Hindoo castes. I saw some very effective ones made at Kumta. They were expensive as well, costing about twenty rupees a piece. The pith can also be put to uses extemporised on the spot. I noticed for instance a farmer using it very satisfactorily as a substitute for bottle cork in a village where corks could not be had. It also serves admirably as a float to a fishing hook.

Typha angustata—It is often known as the Bulrush. Other local names are *Pan-kanesh*, *Ap*, *Gha-pura* or *Gha-bajri*. It grows in marshy places and in tanks. Its leaves being strong and strip like are used for twine by villagers in general, and particularly by *pan* growers to secure the vines to the supports. A more specific use is made of the cottony stuff (awns) which is formed in the mature ear. The ear in flower is an elongated structure about a foot or more in length divided into two approximately equal sections. The upper one is made up of only male flowers and the lower of only female flowers. After the work of the male flowers is over they wither. The female inflorescence at this stage looks somewhat like a *Bajri* (*Pennisetum typhoideum*) ear. Where the seeds are mature they are dispersed by the cottony substance to which they adhere, flying into the air. Before the dispersal takes place this cotton wool is collected. It is used as a styptic. The writer had occasion to use it himself as such and found it efficaceous. The vernacular name *Gha-bajri* implies a *Bajri* which is efficaceous on wounds. The specific name of *Bajri* (*typhoideum*) is on the other hand taken from the generic name of this plant (typha). So both the nomenclatures, vernacular and scientific, establish an association between the two plants.

Were the cotton wool of Typha obtainable in large quantities it could be used in a variety of ways like the silk cotton of Kapok.

Chamæraphis spinescens.—This is a grass with floating habit found in tanks all over the Presidency. It is called *Had* in North Konkan. After the rains are over the tanks are often full of floating masses of its thin wiry green stems. This stuff is used for grazing. Horses, I am told, are particularly fond of it. During the rains about the month of September the grass is in flower which appear above the water. The tank surface would then be mistaken for land by the unwary.

Potamogeton perfoliatus.—This is a submerged plant with transparent leaves. With other allied forms it fills many of the Konkan and Karnatik tanks with tons of vegetable matter. Like most water plants it is devoid of woody matter, easy to drag out of water, and then easy again to dry in the sun, as the leaves are not provided with any mechanism to resist evaporation, being always submerged under water. These characters make it easy to collect large quantities of the plant and store in the dry state. With a view to know if the abundance could be put to any use, which so far lies neglected, a sun dried sample of it, collected at Haveri by me, was sent to Dr. H. H. Mann, D. Sc., Agricultural Chemist to the Government of Bombay, Poona, for analysis and opinion. I quote below from a report which he was good enough to forward to me.

"Chemical analysis of a sun dried specimen of a common water weed (*Potamogeton perfoliatus*).

Moisture.	6·01
* Ash.	19·42
Ether extract.	1·80
† Albuminoids.	11·00
Carbohydrates.	49·04
Woody fibre.	12·73
* Containing sand.	3·67
† Containing nitrogen,	1·77
Potash.	2·13
Phosphoric acid.	0·52

"As a manure it would be valuable locally, probably considerably better when dry, than cattle manure."

ખેતી વાડીને લગતા ટુચકા, કહેવતો અને પદો વગેરે.

(ભરૂચ જીલ્લાના હુન્નર ઉદ્યોગ અને ખેતીવાડી ખીલવનાર મંડળ માટે સંશોધન-થી સંગ્રહ કરી પ્રગટ કરનાર એ મંડળના ઓનરરી સેક્રેટરી ચીમનલાલ હરદેરામ.)

નીતી અને ઉદ્યમ.

૧. કરમ વના નર ખેતી કરે બળદ મરે કે સુકવણું પડે.

૨. ખેડ ખાતર; ને પાણી નસીબને લાવે તાણી.

૩. ઉત્તમ ખેતી, મધ્યમ વેપાર, નકટ નોકરી, ને નીદાન ભીખ.

વીવેચન—એમ કહેવામાં આવે છે કે એક વેપારી વણજારા દેશાવર માલ ભરી વણજાર લઇ જતો હતો. રસ્તામાં એક કુવાના થાળા આગળ પડેલા પત્થર ઉપર ઉપલો દુહો તેના વાંચવામાં આવ્યો. તે ઉપરથી તેણે પોતાનો વેપાર તજી ખેતી કરવા માંડી. તેમાં તેને ખોટ ગઇ. વણજારાને લાગ્યું કે આ કહેવત ખોટી છે માટે એ પત્થરને ઉંધો નાંખી દેવો કે બીજો કોઇ વાંચી પોતાની માફક છેતરાય નહીં. પત્થર ઉલટાવી ઉંધો નાંખવા માંડયો એટલે બીજી બાજુપર નીચેની કહેવત કોતરેલી માલમ પડી.

૪. ખેતી ધણી સેથી, નહીતો ફજેતી.

વણજારો વીસ્મય થઈ વીચાર કરવા લાગ્યો કે મેં તો ઘેર બેસી ખેતી કરાવી. ખેતર પર જઈ દેખરેખ રાખી અને મહેનત કરાવી નહીં હતી. તેથી મને નુકશાન ગયું હશે. બીજે વરસે ઉપલી કહેવત પ્રમાણે ખેતી કરી ત્યારે તેને ખાત્રી થઇ કે "ઉત્તમ ખેતી" વાળી કહેવત ખરી છે.

૫. વાંઢાના વલોણા ને રાંડી રાંડની ખેતી, એ બન્નેની ફજેતી.

મતલબ કે વગર પરણેલો માણસ દુધ દહીના વલોણા કરે અને રાંડી રાંડ સ્ત્રી ખેતી કરે એ બન્નેની ફજેતી થાય.

૬. ઘરના ગોધા, ઘરના જોધ્ધા, ઘરની નારી લાવે ભાત,
તેની સાથે ઘરનો સાથ, ના પાકે એ તે શું વાત

મતલબ કે ઘરના બળદ હોય, ઘરના માણસો જોધ્ધા જેવું કામ કરનારા હોય, ઘરની સ્ત્રી ખેતરે ભાત વિગેરે ખાવાનું લઇને આવનાર હોય, તેની સાથે ઘરના છોકરાં ખેતરે આવનાર હોય તો પછી નહીં કેમ પાકે, પાકવા વગર રહેજ નહીં.

૭. સંપત હોય થોડી તો રાખીએ ગાય કલોડી. (જુવાન વાછરડી)

મતલબ કે પાસે પુંજી થોડી હોય તો નાની વાછરડી ઘર રાખવી કે તેને ઘરનો ગોધો થાય.

૮. કાચે બળદે ખેતી કરે ઉંટપર ચડીને ઉંઘે.

મતલબ કે:—આ પ્રમાણે જે કામ કરે તેને હાની થાય.

૯. આંબ ફૂલે પત નીપજે મહુ ફૂલે પત જાય,
એનેા રસ જે પીએ, તેની અકકલ મારી જાય.

મતલબ કેઃ—આંબેા ફાળે ત્યારે તેને પાંતરા પણ આવે, અને મહુડેા ફાળે ત્યારે તેના પાંતરા ખરી જાય અને તે નાગેા ઉઘાડેા થઇ જાય છે. તે પ્રમાણે જે માણસ એ મહુડાનેા રસ પીયે છે તે પણ નાગેા ઉઘાડેા થઇ જાય છે.

૧૦. કણબી કસર કરસણે, રજપુત કસર રેાટલે,
વાણીએ કસરે જુધ્ધે ને બાયડી કસર દુધ.

મતલબ કેઃ—કણબી સારા સારા છેાડ કદી ફાંસે નહીં, ખેતરની આજુ બાજુના જે નબળા છેાડ હેાય તે બળદ વગેરેને ખવાડવાસારૂ ફાંસે તેઓની સમજ એવી છે કે ખેતરની આજુ બાજુ જે પાકે તે પેાતાનું અને વચગાળે જે પાકે તે સરકારનું માટે ખેતરન વચ્ચમાનેા ભાગ કસર કરી સાચવી રાખે. રજપુત પેાતાને ઘર પરેાણેા આવ્યેા હેાય તે કસુંબેા કહાડીને તેને પાય પણ રેાટલામાં કસર કરે. તકરાર થઇ હેાય તેા ાણીએ જુધ્ધ કરે નહીં. એ વાતમાં તે કસર કરે. ઘેર પરેાણેા આવ્યા હેાય તેા ખેડું-તની સ્ત્રી ઘી ખાવા આપે પણ દુધ આપતાં કસર કરે કેમકે દુધ સાચવે તેા ફરી ઘી થાય પરંતુ ઘી અને દુધની કીમતનેા વીચાર નહીં કરે.

૧૧. ચાકરનું રળયું ચાકર ખાય, ઘરનેા ધણી પચ્યેા જાય,
ને જાતે રળે નેા કેાઠી ભરાય.

૧૨. ઘરમાં બાયડી ને ખેતરે બાવડી.

વરસાદના વરતારા.

૧. ઔતરની વાદળી દખણ જાય, તેા વરસ્યા વના વહાણું ન વાય.

૨. અખાડી શુધ્ધ પંચમી, જો ઝબુકે વીજ,
કણ વેચીને ધન કરેા, હેારેા બળદ ને બીજ.

૩. વા વાયા સુરીયા તેા ભાત કયું પુરીયા.

જવાબ કેઃ—

ધાઉરી વા વાયા તેા હળ છેાડ ઘર કયું નહીં આયા.

મતલબ કેઃ—એક ખેડુત સાંથેકુ લઇ ખેતર ગયેા હતેા. તેની સ્ત્રી ભાત (ખાવાનું) લઇ ધણીને ખાવા આપવા આવી. તે વખતે સુરીઆ એટલે તેાફાની વા વાતેા હતેા. ત્યારે પટેલે પહેલું પદ કહ્યું. ત્યારે તેની સ્ત્રી એ બીજું પદહ્યું કે ધાઉરી એટલે ઉત્તર દીશાનેા વા વાવા માંડયેા છે અને તમે સાંથીકુ છેાડી ઘર કેમ નહીં આવ્યા? હમણા વરસાદ આવશે, એટલામાં વરસાદ થયેા અને બન્ને જણા ભીંજાઇ ગયા.

૪. જેઠ અંતર દેા દહાડલા, જો ગાજંતી ભડ; કુવા કાંઠે કીચડ ને નદી કાંઠે ભડ.

મતલબ કેઃ—જેઠ મહીનામાં ચૈાદસ, અમાસે ગાજ વીજ થાય તેા કુવા કાંઠે ખા. ઓચીઆંમાં પાણી દેખાય અને નદી કાંઠે લીલું ઘાંસ દેખાય બીજે ઠેકાણે પાણી કે લીલુ ઘાસ નજરે પડે નહીં. આ ગાજ વીજ પછી એાતેર દહાડે વરસાદ થાય.

૫. જો જેઠી બીજ ગાજે તેા બેાતેરું કાઢે.

૬. જેઠ ગયેા, અખાડ ગયેા શ્રાવણ રેતુ જ, ભાદરવે જગ રેલ છે કે છઠે અનુરાધા.

મતલબ કે:—જેઠ, અષાડને શ્રાવણ કોરા જાય તો પણ ભાદરવા સુદ છઠે અનુરાધા નક્ષત્ર હોય તો ભારે રેલ આવે એવો વરસાદ થાય.

૭. કૃતીકા કરે કલ્યાણ, રોહણી કરે સુકાલ, જો વરસે મૃગસર તો નિશ્ચે પડે દુકાળ.

મતલબ કે:—કૃત્તિકાનો વરસાદ સારો, રોહણીનો સારો પણ મૃગસરમાં પડેલો વરસાદ કરસણને નુકશાન કરે તેને બાધ લગાડે.

૮. રોહીણી રેલેલી સારી કે ડેલેલી સારી પણ દાઝેલી ખોટી.

મતલબ કે:— રોહીણી નક્ષત્રમાં વધારે વરસાદ થાય તે સારો કે બીલકુલ ન થાય તે ઠીક પરંતુ ઓછો થાય તે ખોટો રોહીણી નક્ષત્રમાં જે ઠેકાણે વધારે વરસાદ થયો હોય ત્યાં દીવાળી સુધી વધારે વરસાદ થયા કરે અને જ્યાં થોડો થયો હોય ત્યાં થોડો થયા કરે.

૯. આર્દ્રા ભરે ખાધરા, ખેડુતના દહાડા પાધરા.

૧૦. આર્દ્રા કરે ઉલામણ તો માસે આવે મેહ.

૧૧. મ્રગસરના ન વાયા વાયરા, આર્દ્રાના ન વરસ્યા મેહ;
જોડી પુત્ર ન જન્મ્યા, તેના રડતાં ન આવે છેહ.

૧૨. વરસે ચીત તો પડે ભીત.

મતલબ કે:—ચીત્રામાં વરસાદ આવે તો એવો થાય કે ભીંત પાડે.

૧૩. જે દીવસે ધુંવેર વરસે ત્યાર પછી છ મહિને વરસાદ થાય. ધુંવેર જેટલા જોરમાં હોય તેટલા જોરમાં વરસાદ થાય ધુંવેર આવ્યા પછી આઠ દશ દહાડામાં વરસાદ થાય તો ઉપર પ્રમાણે બને નહીં.

૧૪. ટીટોડી માટીની ગોળ પાલ કરી તેની અંદર ચાર ઇંડા મુકે છે. ઉંચાણ જમીનમા પાલ કરી ઇંડા મુકયા હોય તો વરસાદ સારો થાય નીચાણ જમીનમાં પાલ કરી ઇંડા મુકયા હોય તો ઓછો થાય.

વાવેતર કરવાની વેળા વગેરે:—

૧. પુષ્ય નક્ષત્રમાં બાજરી ઓરવી.
૨. પુર્વા નક્ષત્રમાં તલ ઓરવા.
૩. હસ્ત નક્ષત્રમાં જુવાર ઓરવી.
૪. ચિત્રા નક્ષત્રમાં લાંગ ઓરવા.
૫. વિશાખા નક્ષત્રમાં ઘઉં ઓરવા
૬. તલમાં ત્રીજુ નહીં અને જુવારમાં બીજું નહીં.

મતલબ કે:—રવી પાકની તલ સાથે તુવેર વાવવી પણ ત્રીજું કંઇ વાવવું નહી. જુવાર એકલી વાવવી તેમાં બીજું કંઈ વાવવું નહીં.

૭. તલ વલા ને કોદર જાડા, મેંદક ઠેકે જાર;
કદમે કદમે કપાસીઆ, સહુથી પાકે જાડ.

મતલબ કે:— તલ વેંત વેંત છેટે વલવાવવા, કોદરા જાડા વાવવા, આછા વાવવા નહીં દેડકો એક ઠેકા મારે એટલે છેટે જુવાર વાવવી. કપાસીઆ કદમ કદમને અંતરે વાવવા.

પાકનેા તથા સારા માંઠાં વરસનેા વરતારેાઃ—

૧. ખાખરે ખરસાળી, કંથારે કેાદરા, ને આમલીએ મગ જાર.

મતલબ કેઃ—જે વરસે ખાખર સારી પાકી હેાય તે વરસે ખરસાળી એટલે ડાંગર. સારી પાકે. જે વરસે કંથારી સારી થઈ હેાય તે વરસે કેાદરા સારા પાકે. જે વરસે આમલી સારી પાકી હેાય તે વરસે મગ અને જુવાર સારા પાકે.

૨. પુર્વ તણેા કાચબેા, જે આથમતે સુર ભડલી વાકય એમ જાણે કે દુષે જમાડું કુર.

મતલબ કેઃ—સુર્ય આથમતી વખતે પુર્વ દીશામાં ધનુષ થાય તેા ડાંગર સારી પાકે.

૩. પાકે ભીંડા જેવા, થાય કપાસ તેવા.

મતલબ કેઃ—ભીંડા સારા પાકયા હેાય તેા કપાસ સારેા પાકે ભીંડામાં જેવેા બગાડ થયેા હેાય તેવેા બગાડ કપાસમાં થાય.

૪. વાસેલવાળેા વાસી નહી રહે.

મતલબ કેઃ—નબળું વરસ હેાય તેા પણ વાસેલ જમીનમાં પાક થાય.

૫. પુષ્યનેા પુળેા, આસ્લેષાની આંઝળ મઘાનેા ભારેા એ ત્રણે બરાબર.

મતલબ કેઃ—પુષ્ય નક્ષત્રમાં વાવેલી બાજરીના એક પુળામાં જેટલા દાણા પાકે તેટલા દાણા આસ્લેષામાં વાવેલી બાજરીના પુળા એક બાથમાં જેટલા સમાય તેમાંથી પાકે અને એક ભારામા જેટલા પુળા સમાય તેમાંથી મઘામાં વાવેલી બાજરીના દાણા આસ્લેષાના પાકની બરાબર થાય.

૬. આસ્લેષા ને ઘઉની ખેતી મસળી ખા.

મતલબ કેઃ—આસ્લેશાનેા વધારે સરસાદ કપાસને બગાડે તેથી તેને બદલે ઘઉ વવાય અને તે પાકે.

૭. આસ્લેષા બાઝે ને મઘા વારે.

મતલબ કેઃ—આસ્લેષાના વરસાદથી કપાસ બગડયેા હેાય તે મઘાનાં વરસાદથી સુધરે. આસલેષાના વરસાદથી કપાસનેા છેાડ પાણીમાં ડુબે તે બગડે અને મઘાના વરસાદથી પાણીમાં ડુબે તેા પણ બગડે નહીં.

૮. ઉત્તરા નક્ષત્રમાં વરસાદ વરસ્યેા હેાય તેા ઘઉં સારા થાય.

૯. વરસે એાતર તેા પાકે ગેાતર.

મતલબ કેઃ—ઉતરા નક્ષત્રમાં વરસાદ થાય તેા ગેાતર ઠીક પાકે.

૧૦. વરસે હસ્ત તેા પાકે અરાડે વસ.

૧૧. વરસે ચિત્રા તેા ધાન ન ખાય કુત્રા.

મતલબ કેઃ—ચિત્રામાં વરસાદ થાય તેા ધા એટલું થાય કે કુત્રા ખાય નહીં

૧૨. વરસે ચિત્રા ને સાંતને માથે પડે.

મતલબ કેઃ—ચિત્રામાં વરસાદ થાય. તેા સ્વાતિમાં પણ વરસાદ થાય. ચિત્રાનેા વરસાદ કપાસને સારેા નહીં. પરંતુ પછાડીથી સ્વાતિનેા વરસાદ થયેા એટલે તેનું નામ બદનામ થાય. એટલે કે સ્વાતિના વરસાદથી કપાસ થયેા નહીં.

૧૩. વરસે સાંત તેા ન વાગે તાંત.

મતલબ કેઃ—સ્વાતિનેા વરસાદ કપાસને સારેા નહીં.

૧૪. દીવાળી પછી સંક્રાંત ૨।. ૨। મહીને આવે તો વરસ સારૂં. ૨।। મહીને આવે તો વરસ નબળું એમ કહેવામાં આવે છે.

૧૫. હોળી સીંચી તેનાપર ધજા ચઢાવે છે. તે ધજા પુર્વ દીશા તરફ ઉડે તો વરસ સારૂં ધજા ઉડી જાય તો વરસ મધ્ય અને હોળીમાં પડે તો નબળું કહેવામાં આવે છે.

૧૬. અખાત્રીજને દહાડે સુર્ય અસ્ત થતી વખતે માટીનાં ઘડાના કાંઠા ત્રણ લેવા અડધા અડધા વાંસને અંતરે ત્રણ કાંઠા પુર્વ પશ્ચિમ સીધી લીટીમાં દાટવા, કે જેથી આથમતા સુર્યના કીરણ સીધા ત્રણે કાંઠામાં થઇને પસાર થાય. સુર્ય આસ્ત થયા પછી ત્રીજનો ચંદ્ર ઉગે તે વખતે ત્રણ કાઠા પૈકી પશ્ચિમ તરફનો પડેલો કાઠો ઉંચકવો. તે જગ્યા આગલ લાકડી દાટવી કે બીજું કંઇ નિશાન કરવું. તે કાઠો ચંદ્રની સામુ દાટવો, કે જેથી આથમતા ચંદ્ર ના કીરણ તેમાંથી પસાર થાય વચલો કાંઠો પણ ઉંચકી પહેલાની સીધી લીટીમાં દાટવો. પછી પૂર્વ દીશા તરફનો પહેલો કાંઠો સહેજ એવો ફેરવવો કે ત્રણે કાંઠામાંથી ચંદ્રના કીરણ સીધા પસાર થાય સુર્યંત વખતે પશ્ચિમ દીશાનો પહેલો કાંઠો દાટેલો હતો અને તેને ચંદ્ર ઉગ્યો તે વખતે ઉચકી લેઇ ત્યાં આગળ નિશાન કર્યું હતું અને ચંદ્રની સામુ તેને દાટયો હતો તે બે જગ્યાની વચ્ચેનું અંતર પગલાથી ભરવું. જેટલાં પગલાં અંતર થાય તેટલાં તોલા (દસેરનું તોલું) અનાજ તે વરસે વેચાશે એમ કહેવામાં આવે છે.

અખાત્રીજ ને દહાડે ખલી કરી જુના ખેડુતો નીચે મુજબ વરતારો કરે છે.

૧૭ અખાત્રીજ ને દહાડે ખલી કરી જુના ખેડુતો નીચે મુજબ વરતારો કરે છે. એક વામ ગામને પાદરે સુર્ય અસ્ત થતી વખતે ગામના કેટલાક લોક એકઠા થાય છે. વચમાં કાળી લાંબી પહોળી સપાટ જગ્યા પસંદ કરે છે. તે લીપી ગુપી સાફ કરે છે. ચાર ઢેફાંના નામ માટીના ચાર ઢેફાં મુકે છે. તે ઢેફાંપર કોરો ઘડો પાણી ભરી મુકે છે. ઘડા ઉપર રોટલો મુકે છે. જેઠ, અખાડ, શ્રાવણ અને ભાદરવો એ પ્રમાણે પાડે છે. ઘડા ઉપર રોટલો મુકે છે. અને કુતરાને રોટલો લેવા જવાદે છે. કુતરો પછી બધા થોડેક છેટે ખસી જાય છે. અને કુતરાને રોટલો લેવા જવાદે છે. કુતરો રોટલો લઇને ગામ તરફ જાય તો વરસ સારૂં નીવડશે એમ માને છે અને શીમ તરફ જાય તો નબળું નીવડશે એમ કહે છે. પછી ઘડાથી હાથ દોઢ હાથ દુર દરેક વાવેતર જણ સની એક એક મુઠી ઘડાને ફરતી મુકે છે. અને બધા ઘેર જાય છે. બીજે દીવસે સવારે સુર્ય ઉગતા ત્યાં આવી જે મુઠીના દાણા વેરાયલા માલમ પડે તે જણસનો પાક સારો નહીં થાય એમ કહે છે. તથા જેના દાણા વેરાયલા નહી હોય તેનો પાક સારો થશે અને જેના દાણા વેરાયલા નહી હોય તે ઢેફાંનાં નામવાળા મહીનામાં વધારે વરસાદ તથા ઘડા નીચેનું જે ઢેફું વધારે ભીનાયું તે ઢેફાંનાં નામવાળા મહીનામાં વધારે વરસાદ તથા બાકીના ઢેફાં જે પ્રમાણમાં ભીનાં થયાં હોય તે પ્રમાણમાં તે ઢેફાંના નામ વાળા મહીનામાં વરસાદ આવશે એમ ધારે છે.

મુંબઈ વૈભવ પ્રેસ.

Agricultural Sayings

BY

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Honorary Secretary, Industrial and Agricultural Association, Broach District.

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I. General.

1. An agriculturist (under Indian conditions) is at the mercy of Fate, since, disease might carry away his bullocks and drought might dry up his crops.

2. Wouldst thou command Fate, cultivate, manure, and irrigate.

3. Of occupations the noblest is agriculture, next stands commerce, lower still servitude, and lowest of all alms-taking.

4. Land without landlord on the spot is a ruinous position (Cf. The Master's foot manures the land).

5. A bachelor acting the dairy maid, a widow acting the husbandman, is courting failure.

6. One's own bullocks, one's own labour, one's own wife to cook one's food, one's own children to keep one company, precludes one's doubt of success in farming.

7. If you cannot buy your bullocks, breed your bullocks; or, if you are poor, keep a heifer.

8. As foolish it is to yoke bullocks before their age, as to sleep over a camel's back.

9. A mango in bloom is clothed with leaves, but a mhowra in bloom is bare of leaves; so mhowra drink (liquor) will make the drunkard destitute like itself.

10. A cultivator is charry of his ears of corn, and his wife of the supply of milk; (since she wants to keep it for butter-making).

11. An absentee's estate enriches the servants, while it just keeps the master going.

12. No house without a mistress of the house; no farm without a well on the farm.

II. Forecasting.

1. If you observe lightening on the Ashád shud, 5th, sell your store of grain and buy bullocks and seed (as it forebodes a prosperous year).

2. If northern clouds steer southwards it is sure to rain overnight.

3. When Surya blows expect a storm when Ghauri blows expect a shower.

4. If you notice lightening on the last couple of days in the month of Jeshta don't expect rains within seventy-two days.

5. If Anurádha Nakshatra falls on the 6th day of Bhádarva (the last month of the monsoon) heavy rains will conclude the monsoon no matter how dry it was heretofore.

6. Rains in Krittika Nakshatra or Rohini Nakshatra are welcome but they forebode famine if in Mrigasar.

7. In Rohini Nakshatra it should rain freely or hold over, but not drizzle, in order to prove it a prosperous year.

8. Happy are the cultivators if it rains in Aradra Nakshatra.

9. There is no end to calamity if the winds did not blow in Mrigasar Nakshatra, or if it did not rain in Aradra Nakshatra or if a son was not born in the month of Jeshta.

10. If it rains in Chitra Nakshatra houses would come down tumbling under its force.

11. Predict a rainy day just seven months and a half ahead by observing the date of excessive due.

12. Expect good rains if a peewit's nest is found on a high ground, and *vice versa.*

III. Sowing Time.

1. Sow Bajri in Pushya Nakshatra; gingelly in Purva N., Jowari in Hasta, chickling-vetch (Lathyrus sativus) in Chitrá, and wheat in Visbákhá.

2. Gingelly has only one companion (*viz. tur* or pigeon pea), Jowari none whatever; (this relates to mixed cultivation).

IV. Miscellaneous.

1. Sow gingelly loose, and kodra thick; Jowari distance is equal to a frog's leap, cotton to a step.

2. If Khákhar (*Butia frondosa*) flourishes rice will prove a good crop; if Kanthár (capparis sepiaria) is good Kodra (Paspalum scrobiculatum) is good; if tamarind yields in abundance, Mag (Phaseolus Mungo) and Jár (Andropogom Sorghum) too will do so.

3. The rain-bow in the east at sunset foretells a bumper crop of rice.

4. As is the lady's finger, so is the cotton crop (since these two crops have common pests).

5. Prosperity after fallow.

6. Pushya-Nakshatra-rains yield most, Aslesha less, and Maghá least of all. (This refers to Bájri crop).

7. Aslesha Nakshatra rains and wheat flourishes.

8. Aslesha brands and Magha heals. (This refers to cotton crop.) Cotton gains by Magha rains and suffers through rains in Aslesha.

9. Uttara rains are best for wheat.

10. Uttara rains favour outer husks; (the glumes are best developed under Uttara rains).

11. Hasta rains are good for all crops.

12. Chitra rains yield a superabundance of rice.

13. The fault of Chitra is transferred to Swáti (Rains in Chitra are injurious to cotton, while the same in Swáti are not so much, yet people find fault with Swáti rains more when they don't get a good crop).

14. Swati rains are not good for cotton.

15. If the sun enters capricorns nine weeks after Divali it will be a good year, if ten weeks after, a bad year.

Note regarding the maning of Nakshatra. The zodiac is divided into twenty-eight subequal divisions; each sub-division is styled a Nakshatra. Indian calendars always denote the position of the sun with regard to these Nakshatras.

Rinderpest and Protective Inoculation

BY

Mr. S. N. Nadgir, G. B. V. C.

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THIS highly contagious disease is not only more serious than almost any other scourge of cattle but is also of more frequent occurrence than almost any other. It is supposed that it took its origin in the steppes of Western Asia and India from which it has at different times spread to Europe or other countries with the march of armies or by the extension of commerce. In India it has existed for hundreds of years and is now thoroughly enzootic and consequently a certain degree of immunity has been gradually acquired and morality is comparatively low. Moreover, by a process of weeding out, indigenous cattle have developed a high degree of hereditary resistance which is not however absolute and a certain number of susceptible animals keep up the infection. As it is generally observed the disease occurs seriously only at intervals in one place, after a serious attack it generally dies out in a province, district or village for several years until susceptible animals increase in number when an outbreak occurs. The first outbreak is virulent and destructive in its nature and as such baffles all remedies hitherto discovered. Within recent years in South Africa it swept a country from end to end and caused untold damages to cattle. In certain parts cultivation of land had to be stopped till a fresh lot of cattle were imported from out-side. All that could be done therefore to eradicate or suppress the virulence of the disease is to adopt special preventive measures before and after it has been prevalent. The common saying 'Prevention is better than cure' applies in this case, only here prevention is the *only* method. Cure is usually impossible.

Before dealing with the advantages of protective inoculation it is important to note that some of the mortality supposed to be due to this deadly plague is said frequently to be due to the nefarious practice of mahars of poisoning the cattle. The growing demand for leather and its consequent high price give a great temptation to such practices, and it is said that cattle poisoning is frequently practised in villages where diseases of a contagious and highly fatal nature exist, for then the cattle owners do not suspect the true reason for the death of their animals and

so the detection of the crime is rendered difficult. How far this is actually done is more a matter of suspicion than of proof. It is even said that occasionally those who will profit by the death of cattle go so far as to sow the germs of some of the most fatal of the diseases such as Rinderpest and Anthrax broadcast by removing the garbage of the plague-stricken animals to different villages where they scatter it over sweet bits of pastures.

The cause of rinderpest is not yet discovered. The blood, secretions and excretions are extremely virulent. The media of infection are numerous. The chief symptoms of the disease are high fever, severe fœtid diarrhœa ulcerated mucous membrane of the mouth and extreme debility. The death rate is very high. No satisfactory treatment has been hitherto found. However the loss may be averted by resorting to timely preventive inoculation.

Out of the several methods of preventive inoculation, 'Serum alone' is the only one in vogue in India. It consists in the subcutaneous injection of varying amounts of serum derived from the blood of the hyperimmunised bovines. Immunity from 'serum alone' inoculation though very short (2 to 6 weeks) is sufficient to tide over an outbreak particularly if affected cases are separated from healthy stocks and strictly isolated. Inoculation will have to be repeated in order to prolong the period of immunity. To obviate this drawback of short immunity it has been recommended to mix healthy animals with the diseased at once after their inoculation. Exposure to infection results in a mild form of the disease being contracted and immunity is consequently active and durable. How far this is wise is, however, still a very moot question.

Rinderpest Inoculation serum is prepared at Muktesar on a large scale and veterinary graduates from all provinces in India are given special instructions there in the method of carrying out the inoculation. As a result, efficient veterinary aid can now be had almost at their door by most members of the public. It is given free of charge and in any part of the Bombay Presidency, and indeed of almost all India. During the year 1910-11 nearly 10,000 head of cattle the majority of them being bulls and bullocks have been inoculated in the several districts of Bombay. Only nineteen of them are reported to have died after inoculation some of them being within the period of incubation. The fore-going number is a sufficient evidence of the advantages to be derived by preventive inoculation. It affords a great deal of satisfaction

to note that people are beginning to appreciate the utility of inoculation and that it is getting more and more popular. Strict isolation of the affected animals, inoculation of the healthy animals immediately after the outbreak and sanitary conditions in the localities go a great way in suppressing the virulence of the disease. Through extension of preventive inoculation it is expected that the disease will be, if not completely eradicated, kept strictly under control in the future.

Experience with Wild Pigs and Successful Methods of killing them by Poisoning

BY

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TO hill-side cultivators, wild pigs are the greatest pests of certain cultivated crops. In consequence of the immense damage done by the pigs to the cultivators, some of the villages situated near hills in the Carnatic and elsewhere, have been entirely deserted and a large portion of good cultivable area in the Presidency is thus lying waste.

The trees, shrubs and general scrub growth on the hills, with the holes and crevices in the rocks afford the best condition for their living and multiplication. Hence a great many pigs are invariably found causing a great nuisance to the cultivators of such villages.

Before going into any more details, it may be stated that the following are the crops attacked by wild pigs given in the order of their choice for eating.

Ground nuts.
Maize.
Sweet potato.
Sugar-cane.
Gram.
} Favourite crops.

Jowar.
Rala.

Bajri.
Tur.
Safflower.
Paddy.
Wheat.
Cotton (green bolls).

The ripening ears of paddy and of wheat and the green bolls of cotton though not greatly attacked here at Gokak, are eaten and damaged to a great extent elsewhere. They do not limit themselves however, to a vegetable diet, and often scratch near trees or in manure pits for grubs of beetles of which they are extremely fond.

The crops that are entirely immune from the inroad of pigs are :—

Chillies, turmeric, ginger, onions, garlic, *Khapali*, betel leaf, plantains and other fruit trees etc.

Although it is very difficult to give with precision, the extent of loss caused by wild pigs to the different crops, still it can be said with certainty that it amounts to not less than fifteen per cent of the favourite crops even with the most careful and regular watching. A greater amount is damaged by their trampling than is actually eaten. Generally a number of wild pigs consisting of adult males, females and young ones, rush suddenly inside a field and commence devouring the crop. They will go on eating and damaging the crop till they are threatened by the watchmen either by pelting stones or by carrying loudly. The watchman during the night sits on a raised platform erected here and there at some short distances in the fields with stones and dogs for watching lest he may be attacked by the pigs if on the ground. If unopposed, they will eat and consume a good deal in a very short time.

There being very few natural enemies to wild pigs, they increase in numbers very rapidly though a few of them are shot or killed occasionally by hunters &c

Foot and mouth disease is, however, very fatal among them, much more so than among bovines. The mortality from this cause it is said often goes to five per cent or more.

The village of Arbhavi in the Gokak Taluka where the Government Farm is situated is just near the foot of sand hills which greatly abound in wild pigs. The cultivators of the place, therefore, have to encounter the greatest difficulties in the growing and watching of the more important and profitable crops. On the government farm standing just opposite to the sand hills, wild pigs began to come in great numbers, and a very heavy loss was threatened, inspite of a number of men kept for watching the crops during the night. Preventive remedies had therefore to be adopted. A four strand barbed

wire fencing with wires ten inches apart and a stone wall four feet in height in front were put up to prevent the pigs from coming inside the area. It was soon found that the pigs after sometime began to come in either by jumping over the stone wall or getting between the first two wires or by making a hole below the first wire in the ground. So two more wires between the original lower wires had to be put in to make the fencing quite proof against the pigs. The stone wall also had to be raised in certain low places where there was opportunity for the pigs to jump.

The cost of putting up a six strand barbed wire fencing with iron standards comes to about Rs. 1500 per running mile, while the cost of a similar barbed wire fencing with wooden posts comes to Rs. 1100 per running mile.

The cost of constructing a stone wall (stone being available just in the neighbourhood) four feet high and two feet thick comes to Rs. 840 per running mile. During the time the above works were under construction, certain other methods for preventing wild pigs as described below were tried of which the poisoning method was a great success, being at the same time very cheap.

(1) A temporary but very effective pig proof fence meant for protecting a sugar-cane outside was made of galvanized wire netting four feet high with four inch mesh, wrapped round *shevri* (sesbania ægyptica) plants grown very thick round a sugar-cane field.

The cost of wire-netting comes to Rs. 16 per fifty running yards. This also prevented jackals from getting inside the sugar-cane crop and damaging it.

(2) A drain five feet broad and four feet deep dug round the area was of no use in preventing pigs as they easily jumped over the same.

(3) Attempts to attract wild pigs into traps were of no avail. Pits twelve feet square and ten feet deep were dug in the most frequented places and filled loosely with rubbish and soil. On the surface of this groundnuts and maize were spread to entice the pigs to go there and fall into the pit. But it was found that not a single pig was thus trapped, even after a long time though more than a dozen buffaloes fell into the pits.

(4) Lastly the most effective and successful method tried was that of poisoning. The poisons experimented upon were arsenate of soda,

Copper sulphate, potassium cyanide, oxide of arsenic (white arsenic) and perchloride of mercury. Of these, the oxide of arsenic has been the only successful poison inasmuch as it has no smell and corrosive action. If a fairly large dose of this poison is taken internally by the wild pigs it produces chloric symptoms accompanied by extreme thirst and the animal is found dead in twenty-four to seventy-two hours near water courses and pools. The action of the poison is especially rapid effective in the hot season. The animal is induced to eat the poison by preparing it as under.

About five tolas of wheat flour are mixed with a tola of oxide of arsenic. To this mixture sufficient water is added to bring it to the proper consistency so as to turn it into round ball. Groundnut kernels are placed here and there on the outside of the balls. The balls together with some extra groundnuts, pieces of sweet potato and maize and cobs &c. if available should be placed on the most frequented paths in the hills. The wild pigs coming from the hills by night, will on their way smell the groundnuts &c. and are thus led to eat the poison with the baits. In no case the ball containing the poison should be kept in the growing crops as the animal is not likely to be tempted to the ball from the crop or perhaps the pig may altogether lose sight o the same.

The greatest care should be taken to see that the poison is not eaten by work cattle and other domestic animals. It should be kept in places frequented by wild pigs after it is dark when all the farm bullocks are taken home and removed very early in the morning, before the cultivators leave for their fields. If once the farmers in the surrounding tract are informed of the deadly effects of the poison, they will be very careful about their animals. However the poisoning should be undertaken only by an educated man knowing fully the effects of the poison on the different animals.

Another difficulty arising in the poisoning of pigs is that the animals eating the poison will not die on the spot but will expire somewhere in the hills and will thus escape detection. The illiterate Mahars and Vadars especially working in stone quarries on the hills on coming across the dead bodies are likely to cook the same and eat and may thus be injured by the poison. It is therefore quite essential to give a wide circulation amongst the inhabitants in the neighbourhood before undertaking experiments with poisoning.

On the Gokak Canal Farm where these experiments were conducted, the poison was kept in the area which was only accessible to pigs as it was enclosed by 5 strands of barbed wires and thus the danger of its being eaten by domestic animals was avoided. With the co operation of the district revenue authorities and the public, the other difficulty was got over by the issue of an order to the residents of the different villages in the neighbourhood that no dead wild pigs should be either sold to others or eaten.

During the past three months of the experiments, about a hundred pigs were killed by poisoning at a cost of about Rs. 6. It is therefore hoped that with the co-operation of the public, a good many pigs might be successfully poisoned annually and that the cultivators in the hilly tract might thus be easily relieved of the most dangerous and harmful pest which exists at present.

The Effect of Drought in an Ahmednagar Village

BY

M. M. Rasal.

[The present article from the pen of a cultivator of Bhingar near Ahmednagar, and a large grower of lucerne under well irrigation, will bring vividly before our readers some of the difficulties really felt by cultivators in many of our eastern Deccan districts. The article was written early in October 1912. Eds]

The district of Ahmednagar in which I reside is usually dry. On the average the rainfall is about twenty-three inches, which chiefly falls during the months of July and September. In the present season, until now, there has been scarcely *four* inches of rain. Lucerne which is the principal crop in my village is drying up, because the wells on which we rely for irrigating it are giving much less water than we usually expect. The price of fodder is rapidly rising day by day, and, on the other hand, the price of cattle is rapidly falling. A good ox, which a few months ago would have cost Rs. 40 -is, as a result of the drought, now sold for Rs. 20 -, and as for inferior cattle, people will

not accept them as a present. All the tanks and rivers are shrinking, and the springs which feed the wells are disappearing. All over our fields which are not irrigated, where usually at this season there is a garment of green grass, the human eye can see nothing but brown bare land. We read in the newspapers of rain falling in other places, even in exceptional abundance, and we hope from day to day that we shall be favoured. But each day is as dry and scorching as the last, and so far our accustomed rain in September and October has almost completely failed us. We hear that some of the villages in this district are actually deserted, not so much on account of scarcity of food as on that of water. Cattle are dying in untold numbers, again chiefly on account of lack of water. Butchers buy up the animals at a cheap rate, and they alone seem to be benefiting by the condition of things.

To whom are we poor farmers to look now when the conditions seem altogether against us? What is the Government to do under these circumstances? When there are seasons of trouble other than those from which we are now suffering, the Government no doubt employs every means within its power to remove the worst miseries of the unfortunate cultivators. In the present case, the authorities have done their best by supplying fodder to the farmers at a very moderate rate. But that is, after all, a help from without, and help of this nature is sure to last but a very short time. We are very greatful to Government for what they have done, but when these troubles occur one after another, our minds sink down under the impression that we cultivators are sure to be ruined some day or other in the near future. This despairing attitude is the prevailing one among the cultivators round here this year.

Still there are some hopes of relief. For the last three days dark clouds are gathering in the sky in the evening, and a few drops of rain have fallen. This rain, though of practically no use, creates hopes for the future, and is looked upon in the same light as a very little water poured into the mouth of man in a great desert would be, where nothing but the heaven above and sand below can be seen. While we were out two or three days ago we had a slight shower of rain on our way, we took off our caps as if to welcome a long expected guest, and counted it a great blessing to have our heads wetted by the rain that fell. The following day we visited several cultivators, and asked them whether the slight shower would be of any value. They replied that just as a small piece of bread placed before an exceedingly hungry man makes

his hunger felt even more, so, similarly the shower would be of no practical use in the case of a crop which has been parched by the scorching heat of the sun during almost the whole season.

This is the position at present.

(It is pleasant to be able to note that one good rain did occur a few days after Mr. Rasal wrote as above, and another substantial shower in November. These have mitigated the worst of the position, but still the condition of the Ahmednagar district is very precarious (16. 12. 12. Eds.).

The Damage of Cotton Seed by Various Gins

BY

Kulkarni, I. S. B. Ag.

THE following is an account of some experiments I made recently at Dharwar to ascertain how far different gins damage cotton seed to be used for sowing purposes. The matter is a very important one, the more so since it has been shown by Mr. G. D. Mehta that the germination of many samples of cotton seed used for sowing is not much more than thirty per cent, chiefly due to damage by the gin.

The way in which I proceeded is as follows :—

I got four bags containing Kumta cotton seed obtained from four different gins, namely (1) Single Roller Machine gin, (2) Japan gin, (3) Surat Hand gin, (4) Foot Roller gin. Cotton from the same well mixed heap had been used for ginning and after ginning, a bagful of seed was taken from each heap, care being taken that each heap was homogeneous. I took five samples from each bag, each sample weighing about three tolas. Thus, I had twenty samples in all. In each sample, I counted the number of total seeds, sound broken seeds and diseased broken seeds. In this way, I found out the percentage of *sound broken seeds* (seeds which had been sound but were broken). The following statement is the average of five samples in each case.

	Total broken seeds.	Sound broken seeds.
	%	%
I. Single Roller Machine gin	5·22	3·98
II. Japan gin.	1·55	·72
III. Surat Hand gin.	·79	·41
IV. Foot Roller gin.	6 12	5·97

I do not attach much importance to the number of diseased broken seeds. They are of little or no use from the sowing point of view, because, they usually cannot germinate, and if they germinate at all, they give rise to weak seedlings which will die after a short time.

From the above figures, one might come to the conclusion at once that Surat Hand gin is the best and Foot Roller gin is the worst from a sowing point of view. But this is by no means true. The percentage of broken seeds alone does not give us any idea of the real damage done to the seeds. Much depends upon the nature of the breaking. In one case, almost all broken seeds may germinate and in another many of the broken seeds may fail to germinate. For instance, in the case of 'Foot Roller gin' only the upper portion is slightly removed and consequently here in the case of many broken seeds, the power of germination does not seem to be lost. In the case of 'Single Roller Machine gin' seeds are actually crushed so that the living germ or the embryo within is entirely destroyed. It needs, however, a germination test in order to ascertain the actual amount of damage done to seeds.

I was obliged therefore to fall back upon germination test of sound broken seeds. I collected all the sound broken seeds picked from the twenty samples I had taken for observation and made a germination test according to the instructions given by Mr. G. D. Mehta in his article on seed testing in a previous number of this Magazine.

The result of the test is as under :—

Gins.	No. of sound broken seeds.	No. of seeds germinated.	No. of seeds not germinated.
I. Single Roller Machine gin.	126	19	107
II. Japan gin.	30	16	14
III. Surat Hand gin.	11	5	6
IV. Foot Roller gin.	186	180	6

We may say that the Foot Roller gin gives hardly any injured broken seeds. Almost all of them have germinated. In (I) out of 126 seeds, 107 seeds have failed to germinate. In (II) out of 30 seeds, 14 have not germinated, and so on. We have already found out the percentage of broken seeds in each case. Those broken seeds that have managed to germinate are not to be considered as damaged at all. The above set of figures gives us an idea of the actual damage caused to the seeds. Thus, we can easily find out by a simple rule of three the percentage of actual damage.

Gins.	Actual damage per cent.	No. in order of their value from sowing point of view.
I. Single Roller Machine gin.	3 38	4
II. Japan gin.	·72	3
III. Surat Hand gin.	·43	2
IV. Foot Roller gin.	·29	1

Thus, we come to the conclusion that if we want to have cotton ginned if we want to get seed for sowing purposes, Foot Roller gin is the best of all and is worth recommending to cultivators for this purpose.

The Experimental Renovation of an Orange Plantation

BY

G. B. Patwardhan, B. Sc.

Superintendent, Ganeshkhind Botanical Gardens.

IN the month of January 1912, Mr. G. B. Kotkar requested Mr. Burns, Economic Botanist to the Government of Bombay, Poona, to visit his orange orchard at Kirkee and give advice with a view to effect improvements. Accordingly the place was very carefully examined by Mr. Burns and myself. The garden was said to have been planted about sixteen or seventeen years back. Out of about four hundred and fifty trees originally planted, only 273 including Pomelos have continued to drag their existence through various periods of

neglect and perhaps over-cropping also. The trees were not yielding a reasonable outturn; they were sickly with many dead or dying branches and the owner had abandoned all hope of them. These two hundred and seventy-three trees do not stand in a single compact block but have several blanks in them. There are one or two clumps of hardy individuals standing segregated and quite apart from the rest, the intervening plants having died away completely. Many of the remaining stood as mere unshapely skeletons of thick wood with loosened bark and a few stray branches bearing a few tufts of green leaves here and there. Some looked completely dead but for a slight faint greenness at the base of the stem. Borers had made a home in the living trees and webs of *Arbela tetraonis* were seen on almost all of them. There were many which though in a very bad condition still yielded some fruit though not in a paying quantity.

On a full consideration of the condition of the trees, the probability or otherwise of their renovation and the amount of capital expenditure the owner was prepared to incur immediately, it was proposed to try an experiment to renovate some of the more hopeful of the trees by (1) pruning all dead shoots and large dying branches, (2) removing diseased portions of them, and (3) thoroughly clearing up the area underneath the trees. Accordingly, an estimate was prepared by me giving the probable cost of carrying out all the proposed operations. A copy of the estimate is given below. The estimate provided for thorough pruning and hygiene and in addition, alternative schemes of cleaning the whole or part of the area according to the amount of capital available immediately. While going over the said estimate, it should be noted that the calculations were based on the assumption that the area to be worked was about sixty gunthas. On actual measuring, however, it was found to extend over only fifty gunthas. Each of the plots referred to in the estimate as 'one-third' and 'two-third' areas were also separately measured on the 2nd August 1912, and were found to be nineteen and thirty-one gunthas respectively (a guntha = $\frac{1}{40}$ acre).

The Estimate. Rs. a. p.

(1) Pruning :—The first absolutely necessary operation is that of pruning all old and dead wood at 265 trees at the rate of one man for 4 trees a day 66 units at 0-0-0 per unit... ... [illegible]

(2) Digging out whole area thoroughly. After the pruning it is adviseable to do a thorough diggin

6

of the whole area which measures 60 gunthas sufficient for 450 trees which number were planted some 16 years back. The land is hard and sodden and full of roots of weeds and so cannot be ploughed deep without interfering with the trees. Digging must be done. Cost 175 cu. ft. per unit-equal to 472 units in all at 0-6-0 per unit, all digging to be one foot deep only... 177-0-0

(3) Ordinary digging round roots only.—Now if sufficient capital is not available to do the whole digging thoroughly, it is advisable to do ordinary digging at the roots only, manuring, and making beds, and irrigation channels for all trees (265) total units 66 at the rate of 4 trees per day per man plus wages of 40 women to carry manure for one day ... ... $\begin{cases} 25\text{-}0\text{-}0 \\ 6\text{-}0\text{-}0 \end{cases}$

(4) In addition to the work mentioned in para 1, thorough digging of one third the area should be done thus spreading the estimated expenditure of Rs. 177 over 3 years. Therefore digging one-third area costs Rs. 59 and $\frac{2}{3}$ area Rs. 16—the total is 75-0-0

(5) (*a*) If the whole is thoroughly done the cost of digging and making beds will be 177-0-0

(*b*) If the whole is finished by simply digging at the roots only—the cost is 31-0-0

(*c*) If one third area is also thoroughly done the cost would come to 75-0-0

(6) The subsequent expenses will be for irrigation and stirring up of soil and water charges:

(*a*) Irrigation a maximum of 25 irrigation turns at the rate 2 units per turn at as. 5 Rs. 16.

(*b*) Stirring soil about 6 times (maximum) at the rate 6 units per turn equal to 36 units Rs. 12.

(*c*) Water charges at Rs. 10 per acre Rs. 27 ... 45-0-0

The total cost as at present advisable to be incurred will come to:

Para (1)	Rs.	25
(4)	„	75
(6)	„	45
	Rs.	145 Rupees one hundred and forty-five only.

(7) The cost of supervision extra.

In the above estimate one unit of labour means one man for one day's work, *i. e.*, 66 units means 66 men for one day.

(8) The present trees will last only about five years more. The value of the crop per tree may be estimated at Re. 1 per tree for four years. To have some trees coming into bearing when the old *ones are taken out it is recommended that from* 100 to 200 new trees be planted. This will mean a considerable addition to the above estimate, however.

Mr. Kotkar's son who was studying as a Horticultural pupil in the Ganeshkhind Botanical Garden carried out all the operations with much zeal and carefulness. The following are the results of the trial.

Pruning:— All the trees were pruned during February and March; the cut surfaces were tarred. Borers and grubs were searched out and destroyed. Mr. Kotkar, junior, himself did also some portion of the work whenever the pruning man was employed by him elsewhere. The cost of the operation was Rs. 20. The quantity of dried wood collected weighed 120 lbs. valued at a minimum Rs. 1 only. After the pruning and until the time of writing 30 trees have completely died apparently on account of (1) the injury caused to the already weak and unhealthy root system, by the inevitable shaking during pruning and probably (2) the shock of pruning sustained by the trees after a long period of drought of the year. Some of these trees had to be cut through and through in search of borers which were so abundant in the plantation.

Two-thirds the area (31 gunthas) was thoroughly dug over by hand, clods were only partially broken as thorough pulverisation of the hard clods seemed impracticable at the time. Beds were made and manure consisting of cattle and house refuge given at the rate of 3 baskets

(60 lbs.) per tree. The above operations with the exception of root pruning and manuring were finished by the 23rd of February 1912. This plot being held in reserve for the Mrig bahar was root pruned and manured later on and the first irrigation given on the 20th of June. The cost of all the operations indicated was Rs. 67-6-0.

The one-third area (10 gunthas) was given ordinary digging round the roots at the end of March, roots were exposed for a short time, pruned and manured. Irrigation for the first time was given in the first week of April for the *Ambe bahar*. The cost was Rs. 15. This plot was subsequently cleaned, *Hariyali* grass (*Cynodon-dactylon*) was dug out by hand and the soil well pulverised in June without injuring the roots which were by this time in a state of activity and vigour as a consequence of their being started into growth by the irrigation commenced in April. The irrigation facilitated the breaking of clods and re-making of beds and in consequence the cost for this was low. It was Rs. 14-4-0. The total cost of improving this plot was Rs. 29-4-0. It must also be remembered that this plot contained some blank areas which was not hand dug but were ploughed.

Now let us see what was the effect of these operations upon the trees. For this I give below the testimony of Mr. G. B. Kotkar who wrote as follows in his letter dated 4th August 1912.

" The result of the operations was very satisfactory. The trees reserved for the *Mrig-bahar* bore abundant blossoms in June. It was a splendid sight to see and enjoy the fragrance of the flowers. The *Ambe-bahar* trees began to throw new shoots with some flowers here and there in the last week of March, and showed signs of improvement. The number of trees at the beginning of the operations was 273 including pomelos whereas the living trees now existing are 243 only. It is to be regretted that the heavy rain of the 21st July, which flooded the whole of my garden ground and *dipped all* the trees for nearly 30 hours, has destroyed almost all the flowers and left the trees pale and weak. But I hope that next crop might be more satisfactory and the trees will still assume an improved aspect hereafter. "

The flooding above referred to by Mr. Kotkar was due to the very high floods of this year of the river Mula near the banks of which the said orchard is situated. On the morning of the 22nd July, the whole orchard was completely submerged not even a single tree crown being visible.

It will be noticed that but for the damage caused by the unforeseen accident of high floods, the experiment was a decided success.

In conclusion, I wish to express my sincere indebtedness to Mr. Kotkar for giving us the opportunity of making an experiment regarding the possibility of renovating an orchard and for keeping careful accounts of expenses incurred over the orchard for the purpose of th operations.

Past Students at the Agricultural College. The Present Causes in Agriculture.

BY

K. B. Bhagwat, B Ag

To,

The Editors,

The Agricultural College Magazine,

THE POONA AGRICULTURAL COLLEGE,

POONA.

Sirs,

PERHAPS the most interesting item in this year's Social Gathering of the College was "The Social Intercourse between the past students of the College and the Professors" held on the first day of the Gathering, namely on the 22nd November 1912. Although owing to the heavy downpour of the rains, the programme of the Gathering of that day was cancelled, this item was kept. We had a fairly representative meeting, their being about twenty graduates from Poona and its surroundings, as also Mr. Bhandiwad from Gokak and Mr. Athale from Sangli. As the intimations to the graduates went rather late, graduates from other places could not attend the meeting. We hope to make the meeting more representative next year. For the benefit of those who could not attend the meeting, a summary is given below :—

The proceedings opened with a short account of the objects of such a meeting by Mr. Ramrao, (lecturer in Entomology) who proposed.

Dr. Mann, Principal of the Agricultural College, to the Chair. Next a paper was read by Mr. Bhagwat on "The suitability of the present courses in agriculture to produce practical agriculturist".

Mr. Bhagwat said that as the posts in the Agricultural Department were now almost filled up, there was very little chance for our graduates to get any entrance in that Department. The only thing left for them was to take up agriculture as a profession, but our three years in the Agricultural College did not fit us for this. The course as at present was too crowded and was a compromise between the needs of research students and those of practical agriculturists. It ought to be made more practical by weeding out some useless subjects which are of no material benefit to a farmer. Some new subjects such as Mechanics and Agricultural Economics ought to be introduced. At present we were neither fit for research nor to take up agriculture as a profession. He also pointed out one great difficulty that a graduate in agriculture had to face, namely, the lack of accurate local information about agricultural conditions in a district, and for this purpose he wished that a survey of our Presidency should be made. He concluded with a suggestion that if the general course were rearranged somewhat after the model of the present "Short Course" when only the most important and practically useful subjects are taught, the course would be immensely improved for the great majority of the students, because after all the opportunities for research were limited, as also the number of students who would in any case take up research as their profession.

Discussion :—

The Discussion was opened by Mr. D. L. Sahasrabuddhe, (Lecturer in Chemistry) who said that the Course in our College must be divided into two branches :

(1) Research.

(2) Practical Agriculture.

(1) Research Students ought to stay with the Professors something after the fashion of the *Guru* and *Shishya* of olden days. Research methods could only be learnt by constant association with experienced persons engaged in Research.

(2) Those who want to go in for practical agriculture should not be made to stay on experimental farms but on farms managed on a commercial basis and for this he wished to have model farms.

If this was not possible, he wished to have a Post-Graduate Course; but this involved a great loss of time.

Mr. P. C. Patil, (Divisional Inspector of Agriculture), said that more practical business training was necessary for our graduates. He stated that in England too, from what he saw there, the course was not very practical. But in Ireland the courses for research and practical agriculture were separate. Their farms of nearly one hundred fifty acres were run by students and teachers. In Holland a still better care was taken in producing graduates. The vacations of the college were utilized on well managed farms of England, because in England the farms were better managed than elsewhere. After graduation, our graduates should be put on some private farm for a year or so. He emphasized the necessity of an agricultural survey of each locality. This was a much felt want. For this separate men were required.

Mr. B. S. Patel (Assistant Superintendent of the College Farm) also emphasized the necessity of a survey. Our information, he said, was very meagre. We had to depend on the volumes of Messrs. Mollison and Mehta which are antiquated. He suggested that there should be a Graduates' Association, which should take up one subject every year and thrash it out. Before joining the College the six months that intervene between the passing of the Previous Examination and the commencement of the sessions at our college should be spent by the students on some Farm.

Prof. Burns, said that if the two courses were separated there would be so much more work for the Staff. The Professors in this college were not whole time Professors but had other duties. The Principal was a Professor of Chemistry and Agricultural Chemist to the Bombay Government. Next he described a Course of Medical Students in Edinburgh which he suggested should serve as a model for a professional course in agriculture. In that course the first year was spent in learning pure sciences and during the next three or four years only those parts of science bearing most directly on his professional work were learnt. The same thing could be done in our college. He admitted that in the present course at the Agricultural College a good deal of pure science *e. g.*, classification and morphology of fungi was taught which was not of much use in practice. On the other hand important practical applications like horticulture were comparatively neglected. He said that a post-graduate course was quite a necessity, but he could

not see how that could be arranged with the present staff who had both teaching and administration to do.

Mr. G. N. Sahasrabuddhe (Sugar Expert) suggested optionals for the 3rd year.

Mr. V. K. Kogekar, led great stress on the survey of local conditions. The backward agriculture of one province may be improved upon by improvements introduced from another. He quoted his own experiences as the organiser of the Deccan Agricultural Association in this matter.

Mr. V. G. Gokhale (Superintendent College Farm) said that if the College did not serve the purpose for which it was started, improvement was necessary, and it was little use going on as at present. We ought to have specialised courses for the two branches for research and practical agriculture; for the latter anybody might be admitted. It should not be made a rule that only the sons of the agriculturists should be admitted. He explained how he, though not the son of an agriculturist, by strong will could create in himself a love for agriculture and said that he would compete with any agriculturist now. Their main difficulty was a smattering knowledge of all subjects which put us at a great disadvantage when dealing with practical agriculturists. Accurate information was necessary. We graduates had no confidence in ourselves and wanted more instances like Mr. Bhagwat. He also pointed out the necessity of model farms.

Dr. H. H. Mann, remarked that he agreed with the Lecturer that the present Course was a compromise and like all compromises not very satisfactory. It was not the best either for research or for practical purposes. But at the same time it helped to produce the embryo farmer and the embryo research man, who could develop into the perfect research man according to the conditions in which he would find himself. He was sorry to find that people expected a college to produce finished products. It was not possible for any college in the country to do. Various remedies were suggested, some wanted two entirely different courses. This would bring in the question of costs. The cost per head in this College was already more than in any other college in the Presidency. Even if the course was not split up before the third year the cost would be still considerable. Besides men who came here did not know what to do. It might happen that a student might take up some subject as his favourite one and might afterwards

repent of having joined that branch, if he did not find opportunities for his subject. He had discussed this point with Mr. Keatinge and Mr. Smart, who wished that optionals should be put in the Course. But when this difficulty that the man did not know their minds was pointed out, no way out of it could be seen. He saw almost an impossible position. Some suggested a post-graduate Course. He had in hand some fellowships, but then our men when they had completed a three years course in college could not afford to pass one year on a farm or in research. Besides our farms as they are situated at present and some private land-lords wanted men both knowing something of research and something of practical agriculture. For them our Course was quite fit. He wished Mr. Bhagwat's paper to be printed and circulated amongst all the Graduates of the College and opinions should be solicited from each on this question, so that next year when we meet we might come to a definite understanding on this point.

In this meeting after this interesting discussion, a proposal was made by Mr. V. G. Gokhale to establish an "Agricultural Graduates Association" which he said, would as an important authoritative body would solve many of the difficulties of our graduates stationed in various parts of the Presidency and elsewhere. The proposal was seconded by Mr. D. L Sahasrabuddhe, who suggested that a Committee consisting of the following gentlemen be appointed to consider about the rules and regulations of the Association at an early date :—

Mr. P. C. Patil.

Mr. G. N. Sahasrabuddhe.

Mr. M. G. Athale.

Mr. K. B. Bhagwat.

Mr. V. G. Gokhale, Secretary.

This Proposal was carried out.

A vote of thanks to the President was proposed by Mr. Kogekar and carried.

Believe me,

Yours faithfully,

K. B. BHAGWAT.

Two Recent Agricultural Pests

BY

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[The following is the substance of a report on visit to Halkarni in the Belgaum district, and to Nasik, in connection with reports of serious damage by insect pests There are a considerable number of new observations contained in the report, which should be widely known. We shall await with interest the result of the experiments outlined against the vine leaf beetle. Eds.]

I reached Halkarni seventeen and a half miles from Belgaum on the Belgaum-Vengurla Road on the 30th October 1912. I found Mr. Bhikaji Shripad Nadganda in the village. He accompanied me to his fields of Rice, *Nachani*, *Nagli*, *Varai* and other millets as well as to a large grass area owned by him The chief trouble in these parts is a swarming type of caterpillar probably of the genus Euxoa Fam Noctuidæ. At the time of my visit the grass had specially been attacked. The leafy portions of the grass had been eaten up and the flower stalks and a few fibrous portions of the leaf only could be seen standing up. The grass extends up to the tops of small hills and the slopes are covered by it. The jungle growth here and there cuts up the grassy slopes, though not very dense, offers difficulties in the extermination of the pest by mechanical means which otherwise would seem to offer some hopes of success.

The grass area, in places of a more open nature, has been cleared and hill millets like *nachani*, *sava*, *varai*, &c. are grown. When the caterpillars had eaten up the grass, they in many places have attacked these millets and caused a considerable amount of loss to the cultivators. In most places the caterpillars had pupated or were just pupating in the soil. The area under the hill millets closely adjoins that under rice. The rice had not been touched up to the time of my visit but that which occupies the lowest portions of the cultivated area might still well be attacked as it required still fifteen to twenty days before harvesting. I, however, asked them to dig trenches to cut off the advance of these caterpillars from the adjoining *nachani* and *varai* plots. When once the rice is harvested there is very little that the caterpillars can

eat. The local name for the pest is शीर *Shir*. From the nature of the attack and previous history this pest seems to be of a sporadic kind occasionally appearing upon crops, and its appearance cannot with certainty be foretold. It was seen in 1902 and again in 1908 but on both these former occasions the pest was not very serious. I asked the cultivators to plough up the cultivated areas of millets from which the caterpillars seem to have disappeared. This would expose the pupæ and kill many. I advised them also to have recourse to the hopper bag to collect the caterpillars and destroy them when on any future occasions the pest makes its appearance.*

The cultivators wanted information on two other pests of Rice which make their appearance generally in August but could not get any conclusive data sufficient to venture a guess as to their nature. But Mr. Nadganda promised to send me specimens next year. They call them by the names Sheda and Kil, शेडा, कील.

Nasik.

I started for Nasik on Monday the 4th November and reached it on Tuesday morning. I visited a number of gardens to see if the Cerambycid beetle *Sthenias grisator* had appeared this year as it did last year about this same time. But nowhere it has appeared up to this time. But it might do so later on as the beetles continued to appear up till January.

The vine leaf beetle *Scelodonta strigicolles* was found in a number of gardens but did not appear to have caused much damage. In one isolated garden owned by a mali this beetle had done considerable damage but the man could not be got to give his consent to allow his garden to be sprayed. At last I was compelled to ask Mr. H. V. Gole himself to give his own garden for trial. This garden is about an acre, surrounded by a hedge. There are other gardens at some distances apart within two to three hundred yards radius. He has given the whole garden in my charge for a whole year and I have arranged the following programme of experiment.

1. The stems of the vines should be cleared off all the loose bark which affords a convenient shelter for the beetle to hide during the day time.

*What is almost certainly the same pest has almost completely destroyed the grass crop this year (1912) in the neighbourhood of Belgaum,—and in addition has done very serious damage to sugar-cane. In the case of the latter crop, some patches were actually killed out by the caterpillar.—H. H. Mann.

2. First spraying to take place in the last week of November with Lead arsenate at 1 oz. to four gallons of water.

3. Second spraying to take place just after the cold season to kill the beetle that come out of hibernation. The strength shall be the same as that in the first spraying.

4. 3rd spraying (only if found necessary) just fifteen days previous to the pruning for the *Amba Bahar.*

Mr. Gole has got the spraying outfit ready and has promised to supply it gratis for the purpose of the experiment. He only wants the help of a trained sprayer, which I have promised him.

Our Farmer's Prognostications

BY

K. K. Bhatarker.

IT would seem to be of advantage to collect together the methods by which our Gujarati farmers consider they are able to foretell weather conditions which are likely to arise Whether the methods which they employ and the indications which they observe give reliable results in all cases may be a matter of doubt, but there is, by almost universal consent, often a good deal of reliance to be placed on the well considered opinion of a cultivator. It is the purpose of the present article to give some account of the things on which they base their opinion.

Our cultivators in Gujarat generally count their new year from the third day of *Vaishakha*, the mouth embracing the latter part of April and the early part of May. The ordinary Hindu year begins in *Kartik*, but to the cultivator the beginning in *Vaishakha* is much more important. It is usually on the third day that their tillage for the coming season is commenced. At this time certain facts are noticed which are supposed to give infallable indications of the season. Some of these facts, which seem worthy of note are as follows :—

(1) The nest of the crow is carefully observed. If it be in the middle of a tree, abundant rain may be expected: if it faces the East,

the season will produce good *crops : if it is turned to the West side, the* year is likely to be a bad one.

(2) The *eggs* of the bird known as *Titudi* in Gujarati (Marathi-*Titui*, Sanskrit-Tittibhe) give indications. This bird only lays four eggs. If these eggs are laid on a high ground and if all of them are laid erect, the rains will pour in *great quantity and in all the four* months of the monsoon. If one of them is not erect, in one of the four months, it will not rain ; if two are so, the rains will not fall aboundantly in two months and so on. The philosophy of this *is that, that the bird* has got sufficient instinct to know whether the rains will be abundant or otherwise ; and so in order to save its eggs from being carried away by rain water, it lays them on higher ground.

(3) The *Holi* festival is one which all of us are familiar with. It is a fire-festival. On this day a pile of wood is set on fire, with much ceremony. It is generally the custom to attach loosely to the middle pole a small flag. This flag, we all understand *must fly away owing to* the force of the flame of the fire. It is the falling of this flag in a particular direction that has concern with our subject. If the flag flies *away and falls down in the Eastern direction, then the year is beneficial* to cultivation ; if it falls in the fire, or in any other direction, the year is likely to be a failure.

(4) A peculiar method of observation is one which we are going to trace below. On the New year day (3rd of Vaishakha) when the sun is just on the point of setting, two to three farmers *go in an open* field, taking with them three necks of broken earthen jars. There, they place the necks in a straight line from West to East, in such a way that the rays of the setting sun which pass through the first neck, must pass through the second as well as through the third. The distance which is maintained between two necks, is generally ten feet. Then they mark the positions of the necks by pitching pieces of sticks, *taking care at the same time not to remove* the necks. On the very night, when it is time for the setting of the moon, the farmers again go to the same place and change the position of the neck in the West at such a distance that the rays *of the setting* moon may have a direct passage through it, not forgetting at the same time that the distance which existed at first, between the first and the last neck, *should also* remain the same at this time. Then the middle one is removed and placed midway between the last and the new position of the first. The position of the middle one is kept such as to allow a *direct* passage to

the rays coming from the first. Finally the last neck is turned in its own place in such a way that the rays passing through the first two necks, may also pass through it. To be short and consistent, the three necks which at first used to make a straight line with the setting sun, now does the same with the setting moon, with no change in the position of the neck which is in the eastern direction. Then the distance between the two positions of the neck in the west, is measured in foot-steps; and it is said that the grains of daily use will sell ten times the number of foot-steps in pounds per rupee.

(5) The last but not of least importance, is the mode of observation, known by the name of "*Khali Bhardi*". The mode of observation, under consideration, is important not only because it is practised all over Gujarat, but because the farmers attach greater importance to it and act cautiously against the evil results which would befall according to the observations made in this process. The meaning of the phrase "*Khali Bhardi*" will not be understood, unless we give a full description of the whole process. On our farmer's New year day, some four or five prominent gentlemen of the village go to the nearest field and enclose there a small area with a temporary ridge, allowing at the same time a short passage for the entrance. In the middle of the enclosed area, four clods of earth are placed. These clods are named after the four months of the monsoon and on them, is placed a new earthen jar full of water. The top of the jar is covered with a piece of *jowari* or *bajri* bread and at a distance of two feet from the jar, heaps, each of a handful of different grains, cotton seeds &c. sown in the particular district in which the observations are made, are arranged. The next morning the farmers go to the field and make their observations If the bread has been shifted towards the village, the gentlemen conclude that the villagers will have their bread, if otherwise, the conclusion will also be otherwise. The next thing will be to see how many clods are made wet and to what extent, by the oozing of water from the earthen jar. This helps them in foretelling about the rains. If all clods are wet with no dry earth in them, they say that the rains will fall in, in all the four months of the monsoon and in sufficient quantity. In short, the conclusion as to whether the rains will fall in all the four months and in sufficient quantity or otherwise is drawn according to the extent to which the clods are wetted. We have already remarked that the clods are named after the four months of the season, and so there remains no difficulty in the way of drawing the conclusion that a particular month will have sufficient rainfall or not. Lastly the heaps

of grains are examined and it is stated that any heap in which by any means the grains have been scattered, will be likely to fail in the coming season.

Such are some of the methods of foretelling weather used by our farmers. Whether any of them are based on sound reasoning, it would be hard to say. But some usually come true, and that is quite enough to maintain the belief in these old methods of forecasting the rains.

A REVIEW.

"Soils, Their Treatment and Agricultural Implements".

—By Rao Saheb G. K. Kelkar.

(By a Deccan Agriculturist)

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THERE can be no two opinions as to the fact that much of our backward agriculture can be improved by the introduction of modern up-to date implements, which will to a great extent save much of our wasted energy, and labour. The efficiency of our indigenous implements is in many cases reduced by the crude nature of their finish. Several instances may be quoted where in one district quite efficient implements have been discovered and utilised which can with advantage be introduced into another, where only quite crude simple ones are found. Now that our country is made accessible by means of railways, such improved agricultural methods can be very advantageously introduced into the more backward districts. We must have only open eyes to observe and then to adopt to our conditions such improved methods. In many cases implements of European preparation may be found suitable. The iron plough may be quoted as an example. It is not now quite uncommon to see in the irrigated tracts of the Mutha and Nira valleys in Ahmednagar and Sholapur Districts or in far southward Dharwar district, the iron plough of Ransom, Sims, Jeffries England or the Arlington plough of America. Much of the credit of introducing these western implements is due to the Agricultural Department of the Bombay Presidency. Some of these western implements, which are generally costly as compared to indigenous ones are nevertheless within the means of individual cultivators, others can be bought by a village on

co-operation, a thing which we have yet to learn. Now that a set of agricultural implements has been placed by the Government for the use of cultivators at district centres through that indefatigable worker for cultivators Sirdar Coopooswami Moodliar, it is quite opportune that we welcome a brochure of fifty-four pages by Mr. G. K. Kelkar, Assistant Professor of Agriculture in the Poona Agricultural College in Marathi titled as above. He is the man who has seen the Department of Agriculture in our Presidency develop from its infancy to its present stage and to him to a great extent along with Mr. Mollison belongs the credit of organizing the department of the Presidency; hence no better experienced man could have written this book. When the Poona Agricultural College was founded, Mr. Kelkar was raised to be its Assistant Professor, an honour well-deserved. Mr. Kelkar though on the eve of his retirement is indefatigable in his keenness for the development of agriculture in the Presidency. His energy and enthusiasm in the pursuit of knowledge is wonderful and many a student has been inspired by the example of this untiring worker in the field of one of the most important branches of industry. The experience of so many years coupled with his immense travelling, for no vacation came, but was utilized by him for studying agriculture in some other province or in his own has made this work peculiarly fascinating for all those who have devoted themselves to agriculture, and no agriculturist should be without this "vade mecum" of modern implements. Mr Kelkar was the life and soul of Shetki and Shetkari Magazine which has become most popular amongst the cultivators since almost all the articles in this very useful magazine were either written by him or at least edited Hence we find that the language used in this book is quite homely and so easily understood by a cultivator who is literate but generally whose education does not proceed beyond the three R's. Even though the cultivator be uneducated, if this book is read at the Chaodi by the Secretaries of an Agricultural Association established in a village, it will serve a very useful purpose. The book is priced at annas eight, a price quite within the reach of cultivators. What makes the book very attractive is the profuse illustrations and the implements described therein. It gives, in fact, within a small compass all the necessary implements that can be used with advantage by the cultivators either by buying themselves, or by co-operation. Mr. Kelkar has done well as he says in the Preface, in choosing only such implements as are proved by experiments to have an advantage over the indigenous ones. In the first part of the book a short account of the soils found in the

Presidency are given, next the chapter on implements. Mr. Kelkar has given the origin of ours, as well as of the American plough—which is most interesting.

In short, the book is so exhaustive and important that every cultivator should obtain a copy of it. We wish it a great success and hope Mr. Kelkar will bring out many more interesting books on agricultural topics which will be useful to the cultivators.

The Work of Local Agricultural Societies and Associations in the North Konkan

BY

K. V. Joshi, B. Ag.,

Superintendent, Alibag Experimental Station.

IT is not unusual to hear as has been pointed out by Dr. Mann in his article on 'Local Bodies as Agents in Agricultural Improvements'' in the July issue of 1912 of the Agricultural Journal of India, the question from the Members of an Agricultural Association "What shall we do?". I have endeavoured in the following paragraphs to solve the question partly and suggest some of the works that agricultural associations situated in my locality (North Konkan) can begin without much hesitation, if the above question is put by its members with a real desire of work for the improvement of agriculture in their locality. Before proceeding to write, what these works are, it would be worth while to point out that improvement in agriculture of a tract can be brought about by the following methods :—

(*a*) Finding better and new methods of growing crops suited to the locality by continued experiments.

(*b*) The transference of better methods of agriculture practised in some parts to other parts of the same or another province where they are not in vogue.

As regards the first method, the agricultural department has already commenced work by opening a farm at Alibag in the Kolaba District for the North Konkan: it will be sometime before the results obtained there will be available for this purpose. Useful suggestions

cannot be made simply from the results obtained from one year's experiment. The experiments must be repeated with success before they can be reported to the public as worth adopting. It would be an unwise plan to advocate new methods of cultivation, manures, or implements before testing their inferiority over local practices for a number of years.

In the meanwhile the agricultural associations in their locality can commence work in the direction of the second method mentioned above, namely the transference of better methods of agriculture practised in some parts to others of the same province where they are not in vogue. Taking for instance the Kolaba district into consideration, one will see that there are some parts in that district where agriculture is in a far more advanced condition than in the rest. Let us then see, what are the advanced conditions in these tracts in agriculture which the members of the agricultural association should try to introduce in the backward tracts.

In the Alibag taluka the system of growing crops like *Ghevda*, *Tur*, etc. on the bunds of rice fields, is largely practised. A similar practice is adopted on a very limited scale in parts of Mangaon, Roha and Mahad talukas, while it is not seen in the rest of the talukas.

The crops on the bunds especially the *Ghevda* crop (called मेघड or वाल in the Alibag taluka) are a good source of income with very little trouble. The cultivation of this *Medhal Ghevda* is carried out in the slack season that follows the transplanting of rice and so it can be conveniently grown by every cultivator. The preliminary tillage of digging and inverting the top soil of the bunds is done at leisure in the hot season. This preliminary tillage has an indirect benefit of keeping the bunds of the rice fields in good order. The only care which this crop requires after sowing is that of protecting the young seedlings from the attacks of crabs till the plants climb up the supports specially erected for that purpose. The crop flourishes well after the rains are over without irrigation and continues till January to February giving a good yield of pods at regular intervals. Besides the pods this crop gives a good yield of green fodder in the end. The probable cause of not growing such bund crops in the backward tracts is the want of information and seed. If the agricultural association will take the work in hand, of supplying information and seed in parts where it is not practised it will be doing permanent good to the cultivators.

The second work which the association can take up is the extension of the cultivation of *rabi* crops after the harvest of rice in the rice fields.

The growing of the rabi crops of *wal* and gram is at present limited to the fields where late rice varieties are grown. The chief difficulty in the way of growing these crops in other fields is the want of moisture in them after the harvesting of rice. This difficulty is got over in the Roha taluka *by sowing the seed wal in the standing crop of rice* about a fortnight before the harvest. This system of sowing *wal* is known there as the *"khati"* system as the seed is dropped in holes bored by a stick in the wet mud. This gives a start of about a fortnight to the crop over that in other fields. If this system is followed elsewhere *rabi* crops of *wal* can be taken in fields where intermediate rice varieties are grown. The extension of *rabi* crops like *wal* in rice fields in the Konkan, should have also for its object, the increasing of the fodder supply. In fields where the moisture does not last till the ripening of the pods, the crop may as well be harvested for fodder. Attempts, however, should be made in the direction of the extension of growing *wal* by the *'khati' system in the rest of the talukas.* This method has two advantages, *viz.* (*a*) giving a start of a fortnight over the other method and (*b*) getting the work of sowing done in the slack season before the harvest of rice.

The third and by far the most important work the agricultural associations can take in hand is the extension of the recently introduced crops of groundnut and jowar on *warkas* lands in the Konkan. It has now been proved by experience in several localities that groundnut and jowar can be profitably grown on such lands. In the extension of cultivation of groundnut and jowar on a large scale the fodder problem of Konkan will also be partly solved. Besides a good yield of pods, the groundnut plants, if dried and properly preserved, make a good and palatable fodder called *"Guli"* which keeps the cattle in good condition if fed in small quantities every day. The serghum jowar flourishes well even under the heavy rains of Konkan and should be grown in rotation with groundnut on the *warkas* lands with the object of fodder only. If the crop be grown with this object in view two cuttings can be easily obtained from the same crop in one season. The only means by which the extension of these crops is possible is the wide distribution of the seeds, and if the district agricultural association through the medium of the taluka and circle associations with distribute the seeds with proper instruction as to their cultivation in every nook and corner of the district it will be doing a great and substantial work.

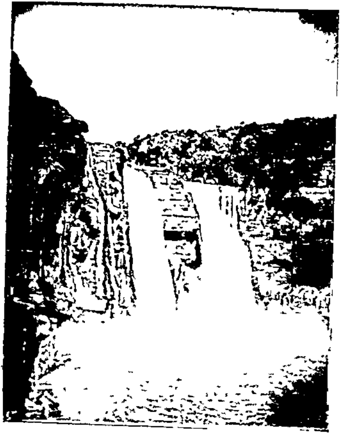
The greatest obstacle in the way of attaining success in the above mentioned lines is the practice, in many parts of the Konkan of letting

the cattle stray in the fields once the crop of rice is harvested. Every cultivator knows what a great nuisance is caused by these stray cattle and it is very needful to put a stop to this. This can only be brought about by co-operation. Many of the troublesome things are checked by "*Garhi*" rules, another form of co-operation and if the members of the agricultural associations will induce the villagers this can also be put a stop to by the same rules of *Garhi*.

Along with this work attempts must be made everywhere to enclose the fields with permanent fences of निवडुंग (milk bush), मोगली एरंड and such others little by little every year. This work can be economically done in the slack season in the monsoon following the transplanting of rice. This will prevent the necessity of erecting the expensive annual fences for the protection of crops and thus increase the margin of profit from them. This is not a new thing in this district as there is a regular system of enclosing the fields by fences of milk bushes in the Alibag taluka and in patches elsewhere and this may be very well adopted by the rest of the people.

The erecting and the keeping up of these fences form a part of the permanent improvement in the land, which cannot be expected to be done from the temporary tenants without substantial help from the owner of the fields. As many of the members of the associations are landowners, they should first of all commence this work on their own lands and induce their neighbours to follow them.

These are some of the lines of work which the Associations formed in this part can adopt and commence work as early as possible. The writer will very gladly supply with any information on points mentioned above and also with seed as far as available.



GOKAK FALLS.

(F. Ag Tour)

The F. Ag., Geological Tour

BY

Henry Van Buwren

IT has often been said that the delight of pleasures anticipated exceed the delight in the pleasures themselves; that this is not of universal acceptance could be borne out by us students who never anticipated such a pleasant time as we had on our tour. Possibly, the accounts of the inconveniences on former tours, greatly exaggerated and then veneered over with a few facts might have prejudiced our imaginations, or it may be that we were sceptical as to the grandeur or scenery that was so near home since the mind ever loves to relegate all that is beautiful to the *ultima thule* region of romance.

To write on the benefits derived from the tour is well-nigh impossible. They can only be very approximately gauged. There were the benefits moral and physical, as well as, intellectual. It gave the best opportunity to engender that *camaraderie* spirit without which a college could be hardly worthy of that name. Then friendships were struck, self-opinionated outlooks were broken down, narrow-minded views gave place to those more broadened and liberal; more than one found worthy in another where worth was never expected. To these benefits must be included those physical. Now no longer does the mill loom up in the mental horizon as suggestive of a tedious distance. Muscle, one finds, does not tell so much as grit and determination. The will to do was always more than half the doing.

The intellectual benefits cannot even briefly be enumerated because each one had much that would be peculiar to oneself, for the same reason the writer trusts that the personal factor whenever suggested will be pardonable.

The novelty of studying Nature apart from books, was perhaps, the feature that appealed to all. Nature presented itself in all its bewildering diversity and challenged us, uninitiated as we were, to read her riddle of underlying simplicity. As one observed and studied, gradually and almost imperceptibly the mind catalogued and labelled phenomena in general laws which came home with redoubled force as

we recalled them from the side-lined, underlined,—in short, disfigured,—pages of one's text-book. Sometimes, as we progressed, we were dismayed at finding our generalizations to be only slightly extended particularizations. Thus we learnt caution in dogmatising.

Our first halt was at Gokak. Here the eyes long sore with trap and nothing but trap, were refreshed with sandstone with its beautiful, laminated and stratified bands. A party of students who preferred visible proofs to faith, led by Dr. Mann and Mr. Sahasrabuddhe, made tracks parallel to the river to find, if possible, the place where the trap overlies the Sandstone. Although undisputable proofs were not found, still evidences were forthcoming to validate such an assertion. The falls near to Gokak are majestic. One fears to attempt any description, a photograph is inserted in the magazine, even this does not at all suggest its majestic grandeur. The wild native scenery is not only worth seeing but also worth going to see.

Belgaum impressed us with its laterite. Its decomposition from trap afforded a good problem that has still to be satisfactorily solved.

Londha gave us gneiss. The grand forests gave ample scope for rambling; many forgot they were geologists and would botanize on every strange and beautiful flower, fruit or plant. Some thought themselves pioneers and so they might have been when they had for their quest the unknown.

Castle-Rock still greatly kindled the adventurous spirit, nearly everyone felt, to a greater or less degree, an infatuation to ramble into every unvisited nook and corner. This reached its climax when led by one of our more daring and intrepid explorers we lost bearings, then we had to consult our compass which showed a way down a steep descent into a river valley. There are still some who had not forgotten the gentle art of sliding which they learnt that day, added to this we had to ford the river in starlight. Then followed a climb through prickly shrubs and creepers through which we had to literally feel our way, sometimes on all fours.

The trudge to Dudhsagar from Castle-Rock is considered by many as the feature of the tour. Geologically, it certainly was most interesting, the shales and schists are of infinite variety, it was with reluctance that we had to throw many specimens away because we could not carry them. The falls at Dudhsagar lose most of their impressiveness

by being broken up into three main portions. In selecting adjectives to describe it, one would prefer beautiful and splendid to those of *gorgeous* and *grand* which latter more befit the falls of Gokak. Still the Dudhsagar falls are yet in its infancy and one wonders what it would be like in a few more thousand years, that it would easily rival the falls at Gokak is not merely a matter of wild conjecture.

Dharwar was the next place visited. Some would have thought that the farm came as a rude reminder in the midst of our enjoyment that we must not forget we were going to be agriculturists. The neatly kept farm with the experiments so carefully led out filled one with admiration for the *science that could do things so methodically* and systematically. Many never forgot that they had come on a geological tour and it is to be feared that as our courteous Superintendent took such trouble to explain the experiments, some would took round and securing a specimen, the whisper would go round, "hœmatitic quartzite"!

Sunday was spent quietly in Gadag, here Dr. Mann addressed a *few of the students who wished to hear him.* The *romantic surroundings* with a thoroughly agricultural background still lingers in the memory with which one will always recall the words of help and courage given to us in our battle in this life to be men in the truest sense of the word.

The next day we continued our geological explorations, getting, here, rocks correlated with the Dharwar system.

Bagalkot had fresh interest to us, as we got limestones of various colours. Those who, led by Dr. Mann, climbed to the *top* of a *hill* in the neighbourhood will never forget the view it gave of the whole country and afforded as it were a key to the rocks found in the neighbourhood. Stretching far on the one hand, one saw the trap area with its black soil and dead *level* country. On the other hand, one got the limestones, quartzites and a curious brecciated conglomerate which suggested metamorphism through the heat of the lava flows which was contiguous to it.

Bijapur was the last place visited, here we combined archæology (or what we thought was so) with geology. An interesting find of pumice stone on a small hill created great interest, it afforded con-

clusive proof that we were on the latest of all the lava flows, and confirmed the theory put forward for the secondary deposition of calcite in large pockets which characterised the railway cuttings through trap. Space forbids mention in detail of the hospitality we met with all through the tour. The concert held at Bijapur on the last night of the tour was a fitting *finale* to everything. Here it would be but right to express our thanks and the deep debt of gratitude we owe to Dr Mann and Mr. Sahasrabuddhe. As the people of Bijapur did eulogise Dr. Mann and his work and garland him, we students felt that our appreciation might as well be shown; it took the form of the real Britisher's appreciation and as we shouldered him to the strains of "He's a jolly good fellow". It can better be understood than described that none would have dared this liberty had they not forgot the Principal in the discovery of a friend. Mr. Sahasrabuddhe, we remember for his kindness, ever ready to explain any difficult phenomena and even repeat it to every student who would ask for a repetition, however annoying and disgusting constant repetition would be to him. His patience and tolerance coupled with his sympathy will be very hard to forget.

The Agricultural Tour 1912

BY

One of the Party.

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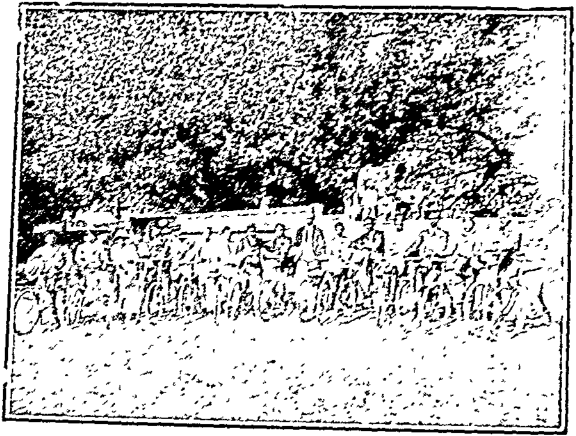
MESEEMS the student of agriculture if he ever has an ugly customer to deal with, it is the book-taught philosopher whose mind is filled with nothing but what Goldsmith expresses as the "vulgar errors of the wise". He has, more than all, a journey through life for which books alone cannot qualify him but may rather be the cause of his blundering on and finding himself very soon undone. A budding agriculturist needs the qualifications of a St. Thomas who would not believe but he had seen with his own eyes and touched with his own hands. It is difficult to say if any among us be not like to the saint, but it is undoubtedly true that the seed of expectation sown by every present B. Ag. student the moment he crossed the



CYCLE PARTY.

S. Ag. har awakened in him, as each day brought him nearer to its blossom, an ever-increasing desire to go on the prescribed tour as far and wide from his present Deccan home as the sanctioned purse would allow and time permit. And hence on October 14th we left Poona for the dust and din of other cities, to see other soils and those enamelled with flowers different from our own and later also to enter those primeval forests, beneath whose silent shades God's dumb creatures still lurk in savage freedom, and in wondering contemplation to pass through the varied and rich profusion of the vegetable kingdom, its creations lying mingled in apparently wild yet beautiful confusion.

Our course as outlined after mature and mutual deliberation included besides the important stations, so well described in the accounts of past tours, a run through Kathiawar and a cycle ramble through the ever verdant woods of North Kanara. A study of either has been sketched under special heads by abler hands than mine, and I will therefore pursue only the happenings of that time when we were long absent from home.

It was not without misgivings on the part of the authorities and full confidence on our own as to the tension of our nerves for the fulfillment of the varied programme that adieus and bye byes were exchanged before the train steamed away. After a few hours' stay at the Veterinary College in Bombay where we turned our hands seriously to that important branch of our studies "Bovine Pathology," we quitted the shores of the busy city for Verawal where the *Sabarmati's* paddle and screw brought us in safety over—thanks to the elements—a smooth sea; for once land was quite out of our sight and all around a glorious mirror, seemingly boundless, endless and sublime.

At Verawal we had just time to saunter through the maze of narrow streets whitened with limestone and to gaze in our passage at the tall white buildings so close to each other. To the people, almost all of whom appear to be Mahomedans by religion we seemed a heterogenous set of curiosities let loose from some zoo and neither our thirsty looks nor the jingle of our purses would induce them to overcome their scruples and admit us to their tea-shops for a cup of that refreshing beverage. We took train at noon on the Junagadh State Railway and sped through country with a fair cultivation of jowar and cotton in general, and having the Gir forests looming in the distance. At Rajkot, we stopped in the evening and after a late supper and a few hours'

nap, we were up again and on our way very early over the Morvi Railway towards Wiramgaon. Cotton along this tract looked better than on the Junagadh side and the abundance of grass all along in this sandy region proved a marked contrast to the bareness which always meets our eyes in the Deccan. Peafowls and pelicans could also constantly be seen on either side of the line. From Wiramgaon, after changing from the not over comfortable metre gauge to the broad gauge of the B B. and C. I. we came in about an hour and a half to Charoddi where the Kankreji breed of cattle in all its purity holds majestic sway on the vast breeding farm. The system of sorting and isolating of herds according to age, the careful management needed and the extensive area of the farm gave us an idea as to what it means to keep a good breeding farm. A practical demonstration on the saying "There's many a slip between the cup and the lip" was also given by one of the tourists while strolling over the area bunded for rice cultivation.

From here we moved to Ahmedabad where many a Paul Pry in trying to examine the beauties of the drains at the savage Pumping station got his olfactory nerves so tickled with some refreshing odours that he thought the whole of Ahmedabad was sprayed with the scent and had it likewise—possibly by process of absorption—in its vegetables and fruits. The black savage water on the farm made us wish for an improvement on the present system of sewage application to the crops which showed dyspeptic symptoms from excessive feeding. A visit to the cattle market in the evening proved very instructive both in the discrimination of various breeds and the methods of buying and selling. Many of our men would fain have put their veterinary knowledge to practice here had they tow and powder and lotion to hand

Proceeding to Nadiad, the kaira kodra mixture mixed us up into a discussion on the relative merits of mixtures and rotations. For want of sufficient rain, the tobacco was being grown under irrigation. Instructions were kindly given on tobacco curing and sericulture and later we were treated to a hearty tea by some of our old friends whom we were right glad to meet and to recall pleasant memories of happy hours spent in company in the College.

The same evening found us at Baroda, where being no longer "cabined, cribbed, confined," we let ourselves loose till the following evening, which was a Sunday, in the wide and splendid thoroughfares

of the city. One can imagine what all we saw when I say that late on Sunday evening several were heard to dream aloud and tell their friends far far away in language most elegant and choice the beauty and worth of the Public Gardens, the Museum, the Makarpura Palace and all else that Baroda had to show them. The Dussera procession with all the pomp of State was a long feast for our eyes till we longed for that other feast which we knew was in the making in the Baroda College grounds. And right heartily did we fall to it with lavish thanks to Mr. Raje for closing with a royal repast a royal day spent in a royal city. Posibly the dreams were the effect of this, for in some quarter of the carriages at dead of night were also heard words running high on the merits of tea and coffee.

With the rising sun of Monday we were again the old hunters after farming lore and at the farm were shown various experiments on cotton and tobacco. The *bajri* crop, though we were told it was poor this year, was decidedly superior to ours.

At Surat, we proved, I am afraid, a bit too troublesome to Mr. Gulabbhai our genial host. We had two days on his hospitable farm and not a moment but he was ready with a smile and practical answer to our questions and cross-questions. Drainage, interculture, straight sowing, garden crops and their economics were interesting studies here, yet too many to be done in two days or described in a few lines. We left the place with great regret, invoking blessings on our kind friend.

Coming to Dhulia, the size of cotton made us believe our eyes were suddenly turned *small* sighted in consequence of the heat of Guzerat. Things looked drear and patchy all around, and we were glad to be back again on our way to Poona on the 26th afternoon to start anew for the southern trip. As we came towards Nagar the sky looked sullen and we were glad to see signs of good rain all the way. At Poona we learnt there had been almost an inch and a half of rain that day.

The Southern Mahratta country wore a much greener aspect than what had hitherto come to our view. Hukeri Road was the first stop, on the 27th evening, from where we ventured on our cycles, which now accompanied us, to visit the Gokak Falls. The next morning the cycles took us to the farm where we saw among others the salt washing and irrigation experiments. We noticed also cotton sown mixed with

chillies. Mr. Bhandiwad told us of his successful attempts in the extermination of pigs which were a source of great nuissance to the sugarcane crops.* He was again extremely kind to us and we owe him our sincere thanks. On the 29th evening we were for a few hours at Belgaum where Mr. Kangle gave us a short dissertation on rice cultivation and varieties in the district after helping us to the discussion of some choice delicacies which he and Mr. Mallishli in all kindness had busily prepared.

At Dharwar we were busy with pencil and note-book from 9 a. m. to 12 noon, taking notes on rotations, tillage, manures, cottons, jowars, seedrates and many other things besides, till we were invited to regale our inner man—thanks to the kindness of our past friends at the College. Bajac's plought† which hitherto we had only seen in illustrations was shown to us in the evening, after which Messrs. Bendigiri and Inamdar were at home to us at Mr. Bendigiri's residence. The same evening we left the place and came to Haveri where the cycle tour commenced. That it was pleasant throughout is unimpeachable and if ever we had reason to be ill conditioned or cross grained like Gabriel Grub it was only at the end of our first thirty mile run when we arrived at Hangal and found that it would be several hours before our kit came up, and that we would have to make ourselves comfortable that night under the roof of an otherwise open building by the side of a tank. But we learnt from this how to avoid such extremities and rolled smoothly on over the smoothest of roads to Sirsi, Siddapur, the Gersappa Falls and Gersappa town. The spice gardens at Sirsi were worth all the trouble we had taken to come and see them. To the owner we can never be sufficiently thankful for all his interest to see that we were comfortable, and for his clear explanations on spice gardening which manifested his deep understanding and practical judgment and experience on the subject. The Siddapur gardens were not on a par with those at Sirsi. There seemed to be wanting a good bit of that care which we saw was being given to the Sirsi gardens.

At the Gersappa Falls we had a real holiday. We had a view of the falls both from the Bombay and the Mysore sides, and ventured even to fathom the depths where we were caught in the eternal rain of the place. *From here we rode to Gersappa town over about a six mile*

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* For his article see page 164 of this number.

† See Mr. Keatinge's article in No. 1 Vol. IV.

ascent and then through as many miles of a continual descent. It was a relief to us all to meet at the town and to find that we had done the whole journey scatheless save for an occasional puncture or a fright at the sight of a panther in the distance which we were told in one instance made one of our party cut a sorry figure by having to run for dear life with trousers half downed. At Gersappa town we took boat for Honawar where Mr. Basrur's mango juice factory was an interesting study deserving high commendation. We are greatly indebted to his sincere kindness to us and cannot but wish him success in his great venture on the canning of mango juice.

From Honavar the steamship *Netravati* brought us back to Bombay *via Mormugoa though not as smoothly as we might have wished.*

The success of the whole tour is beyond doubt. We have learnt from it lessons and experiences which will ever remain imprinted on our minds, and we are deeply indebted to Mr. Knight for the patient *kindness with which he led us through every item of it and not less to* Mr. B. S. Patel who also accompanied us.

The illustration which shows the Cycle Brigade reminds me of Mr. Godbole who did excellent work with the camera, taking many and beautiful views wherever he could. We should be much obliged to him *for copies of the views* which would serve as mementoes of one of the pleasant times we have had *during our term of scholarship* at the Agricultural College.

Spice Gardens at Sirsi, Kanara District.

BY

Felix J. Fernando.

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The cultivation of spices has been one of the most interesting and instructive studies of the final year students of this College while on their recent Agricultural tour through the southern part of the Presidency. This cultivation is not found elsewhere in Bombay, and hence was quite a new crop to most of us who were from the Deccan. They form, however, an important article of commerce in North Canara where the natural conditions favour their growth, and where they can be grown with little trouble and expense. The rainfall of Sirsi in this district is about one hundred and twenty inches per annum, arranged on the average as follows :—

		Average Rainfall in inches.
January	...	1·57
February	...	
March	...	
April	...	
May	...	2·46
June	...	24·88
July	...	36·23
August	...	20·84
September	...	8·09
October	...	5·53
November	...	1·11
December	...	0·42
	Total...	100·03

One of the most important considerations in the cultivation of Spices is the selection of land for the purpose. The most suitable lands are valleys or hill sides where perennial *nalas* run. Having selected the land, plantains are thickly grown to serve as a shade crop for the main crops which are Betelnut, Cardamoms and pepper. The cultivation is

started with the transplanting of betelnut which is at first sown in nursery beds. When three years old, the betelnut seedlings are planted at a distance of twelve feet apart among the plantains. When transplanted, the seedlings are about four feet high. The transplanting of the betelnut seedlings is done in circular pits. Pits two feet in diameter and eighteen inches deep are dug out and leaf-mould manure together with plantain stem refuse is added to it, after which the seedlings are put in. The leaf-mould manure is prepared from the leaves fallen from older betelnut trees. Eight years after transplanting, the betelnut trees begin to bear when a second batch of seedlings is transplanted midway between the mature trees so that there are mature trees and seedlings alternately at a distance of six feet. The plantain trees are gradually thinned out as the betelnut seedlings are put on in the field. The betelnut trees live for about fifty to sixty years but it only pays to an age of forty years.

Cultivation of Cardamoms.—If the plantains provide a very thick shade the cardamom seedlings are transplanted at the same time as the betelnut otherwise they do not thrive. They are propagated in nursery seed beds.

The size of the seed beds which are usually made is six by ten feet. Fresh, well grown, healthy, mature, green cardamom seeds are used for seed purposes. The seeds are mixed with ashes in order to remove the sweet gelatinous coating of the seeds before drying to prevent insect attack. The seeds are broadcasted in September, two months after which they germinate. After broadcasting the seeds, plantain stems cut into two are spread over them to provide heat and shade. A month later (in October), the plantain stems are removed from the seed beds and *Avala* (*Phyllanthus Emblicus*) leaves substituted in their place. A month after this (in November), the seeds begin to germinate and the young seedlings make their way through these leaves. If germination does not take place a little hot water is sprinkled over the seeds to stimulate them to growth. The seedlings are left in the bed till four months after germination that is to say until the following March.

In April, the seedlings are transferred from the seed bed to a nursery bed and left there for a year. In the nursery the seedlings are sown on ridges at a distance of eighteen inches apart, water being given when necessary and shade provided. The nursery should be provided with good drainage.

Fourteen months after sowing the seed that is to say when the seedlings are one year old they are transplanted into the permanent garden between every two betelnut trees. Sixteen months later, they begin to flower, the bearing season being September to December. The fruits appear in panicles just above the ground. Formerly, when one set of seedlings were transplanted there was no necessity of preparing new seedlings to take the place of the old ones as the young suckers developed new plants. But now owing to a disease called the "*Kathi*" Disease which has not yet been investigated, new plants must be put in place of old ones about once in every four years. Nothing is yet known about the cause of this disease.

Pepper Cultivation.—Twelve years after betelnuts are transplanted into the permanent garden about three or four mature pepper vine cuttings about six feet long are planted round the base of the betel palm, six inches deep in the soil, and are tied to the palm to prevent them from falling down and to help them to climb. The reason why the pepper is not planted earlier is because the stem of the betel palm is very green smooth and slippery and hence, the pepper cuttings cannot have a firm grasp of the stem to climb. Therefore they have to wait till the stem becomes quite rough and thus enable the cuttings to grow and climb easily. In some cases the vines are first made to trail along sticks, then they are cut and inserted round the base of the palm in order that they may grow easily upwards. Seedlings from seeds are, as a rule, not grown because they require more time to grow and live for a shorter period than plants from cuttings. The cuttings are planted in May.

Drains are made at a distance of twenty feet apart being two feet deep and nine inches wide at the bottom with cross drains to secure good drainage. During the hot season channels are made for irrigation water to flow through and the water percolates and is carried to the roots of the plants by capillary action thereby preventing the roots from being water logged. This system of irrigation is highly satisfactory. The gardens are watered twice a week from perennial nalas running down the hills by the side of the gardens. Some gardens require water daily. As the rainfall is heavy, large quantities of soil are annually washed away from the gardens. The soil thus lost is replaced every alternate year by soil from hill sides. With regard to water, one point must be remembered and that is that water which is puddled and full of silt will not do for the delicate plants.

Pepper and cardamom cultivation at Sirsi.

The leaves used for manuring are brought from the surrounding forests, every cultivator being given nine acres of forest land, free of rent, for collecting the leaves, for each cultivated acre. Vast quantities of leaves are brought from the forests and put under the cattle to absorb the urine, fresh leaves being supplied at intervals. The gardens are levelled and manured every alternate year. Broken leaves fallen from the betelnut trees are removed frequently to prevent the cardamom plants from injury. The gardens are weeded twice every year. Six maunds of Farmyard manure (28 lbs. = 1 maund) are given for every two trees of betelnut (*i. e.* one old tree and one young one). Out of this, a little manure is used for cardamom and is applied when the betelnuts are manured.

Outturn.—There are 500 betelnut trees to the acre, and the outturn of shelled and dried betelnut is on an average about two *khandies* or twenty maunds (560 lbs.) per acre. An excellent crop may give even two and a half *khandies*. The price of nuts is very variable and ranges between twelve annas and a rupee per maund (28 lbs.). It fluctuates very much and may go up even to three rupees.

On an average eight maunds of dried black pepper can be obtained from an acre. It is sold at eight rupees per maund, and thus gives a gross income of about sixty-four rupees.

Cardamoms give on an average about two maunds per acre and they are sold at sixty rupees per maund thereby giving a gross income of about one hundred and twenty rupees.

It must be remarked that the cultivators are very economical and fully realise the value of manure and organic matter, and hence make the best use of every little bit of manure and urine that they get hold of. The preservation of urine is a great contrast to the wastefulness of the urine in the Deccan. Still more marked is the efficient method of irrigation by capillary action and the application of water and manure, not by a hard and fixed rule and in large quantities but as much as the plants require and when necessary. The methods of cultivation are very efficient and highly satisfactory. An investigation into the cause of the disease which has recently manifested itself in the Cardamoms is very much desired and will undoubtedly prove very useful to the cultivators.

College News and Notes.

ERE this number reaches our readers, the year 1912 will have run its course, and we shall have commenced a new year of hope and expectation. We tender our best greetings for the New Year to all our readers, to our staff and not less to our companions in study, to whom in particular our wish for all their undertakings in the New Year is: "Be bowled out or caught out but never throw down the bat."

The Social Gathering this year was damped by the unusual weather we had in consequence of a visit from the late rains. From the experience of past years in which the function, held in October, was usually marred by the rain, the date this year was postponed as far as possible from such a contingency. But it broke our spirits not a little to see that we were in the midst of heavy rain on the eve of the Gathering. Not even the "chowghada" whose din resounded for miles around the College hall seemed to entice the sun the next morning from out of his concealment. The programme of sports and games for the day had to be postponed *sine die* as the weather report showed little likelihood of an early break in the existing conditions. However, owing to the presence of a large number of ex-students some of whom had come from a great distance for this great occasion, the evening was employed in a friendly intercourse between them and the College Staff. The idea of this move which has originated only this year is an excellent one and gives all past members of the College an opportunity to interchange opinions which must result in some good, both to the College and those who have had their education there. An account of this *reunion* ispublished elsewhere in this number.

On the morning of the 23rd the sky wore still a threatening aspect till at nine O'clock the sun gradually unveiled itself and instilled at once into all, a sudden vigour, to begin the sports as soon as possible and to get through as many items of the day's enjoyment as time would allow. Accordingly, the sports were commenced at 12 noon and save for wrestling and swimming which were two of the most important events, but had of necessity to be postponed, a spirit of activity and enthusiasm on the part of workers and competitors helped

every single event to be enacted successfully. The competition was very keen as could be noticed in the exceptionally large number of entries for the games, and the winners among so many deserve credit.

Sports done, the Hon'ble Sir Justice Chandavarkar, who did us the very great honour of presiding on the occasion, after a stirring address full of sound and practical advice, gave away the prizes which stood in beautiful array before him. The many entries and the hearty response to the appeal of the Sports-committee for kindly donations enabled the latter to make an excellent selection of valuable presents, which included also prizes offered by the general secretary for the gathering, the editors of the Magazine, and the Fernando brothers. Mr. Inamdar deserves our special thanks for working most energetically to make the prize-giving an absolute novelty and success.

The evening wound up with light refreshments and dramatic performances in English and Guzerati. Both were interesting and kept us absorbed till midnight. The English programme included a humorous sketch "The Mutton Trial" and a very original and amusing display of living pictures entitled "Dr. Flannagon's Bioscope" by Mr. T. C. Drieberg. The Red C. the charge of the Light Brigade, the feat of the great Ceylon Hercules in having a motor run on his chest were among the items which kept the house in roars of laughter. Our Guzarati friends were also well up in their acting and Mr. Bhatarkar particularly cut a good figure as the empty dandy.

On the following Monday, the Marathi play which was to have been put on the boards on Friday was acted, before which Prof. Shukla gave us a display of his powerful memory. The play was a tragic one and I think it is too little to say that every one, especially Mr. Godbole, did his part most naturally.

With this however, the Gathering did not end. The swimming and wrestling competitions which were kept aside were held on the 7th of December at the Kirkee Quarters, where before a large concourse of the students, Mr. Masani (senior) easily laid low Mr. Abro in the senior round, and Mr. Prabhune came off best in his tussle with Mr. Mandke. Mr. Mandke however made up for his defeat by winning the swimming race.

At the General meeting of the staff and students on the 16th of December, the prizes for these last events were given away by Dr.

Mann, and also to the best actors in the different performances, among whom were Messrs. S. R. Godbole, Drieberg, E. Fernando, B. J. Patel and Bhatarkar. This latter set of prizes was kindly offered by Mr. Ranade of the College Research Laboratory.

At this meeting there was also presented to Rao Saheb Kelkar, who recently left the College on long leave, an address of farewell by the students. Rao Saheb Kelkar has been connected with the Agricultural department for over twenty-five years and his uniform energy throughout and his affable kindness to the students deserved much more than the little that we could give him. Rao Saheb Kelkar replied in fitting terms to the address and also gave a bit of practical advice to the students which was received with cheers.

At this meeting which will probably be the last of this College year also appointed the whole staff to be judges in the awarding of the Ahmed—Mann medals for 1912–1913. The procedure for the selection of the most public-spirited student in each class is to be the same as last year except that instead of five members of the staff, the whole staff is included in the committee for the final selection, the suggestion was made on good grounds by Mr. V. G. Gokhale and adopted by the meeting. The names of the medallists will be published in the next issue.

Dr. Mann closed the proceedings of this last general assembly with one of those rare sermons of his, which will make even the most desperate and despairing feel, that life is worth living and that there is something for everyone to do everyday of his life in this world. He also thanked Mr. Godbole the general secretary for the Gathering and all who helped him to make the Gathering as enjoyable as it had been under the strenuous circumstances already mentioned.

It gives us great pleasure to note the appointment of Mr. Amritlal C. Desai L. Ag. as Agricultural and Industrial expert in the Indore State. Mr. Desai passed from the College in 1904 and after serving till 1907 in the Bombay Agricultural and Imperial Departments went on tour throughout India having obtained the Hindu Education Scholarship for sugar. He studied the sugar problem and wrote a report on his studies. Later he went to America where he undertook the study of the sugar industry, including the refining of sugar. He also took up the course of Agricultural Economics obtaining the M. A. degree

from the Wisconsin University. He returned to India last March and we have reason to congratulate him on his important appointment.

Mr. G. N. Sahasrabuddhe who also went out to study the same subject in the West Indies as a Government of India Scholar returned to India in September and we should be glad to see him well appointed for the experience he has gained.

Mr. P. C. Patil, Inspector of Agriculture, C. D, who was sent to Europe by Government to study the Agricultural conditions and organizations in different European countries is again among us now, and we should be glad to see our country improve by the wide experience he must have gained in foreign Agricultural countries.

There is very little to be said for the various departments of the Gymkhana except for Tennis and Hockey. The Tennis tournaments were a decided success and we have pleasure in giving the names of the champions. Hockey matches have been played, we believe, more often than the cricket matches were ever played and lately our team was able to defeat the Eurpean Police Team.

The Middlesex Regiment also met our team in the field when some fine play was shown on either side, the Regiment scoring just one goal at the very last moment of the game.

Our men also expect to meet a team coming from Allahabad during the X'mas vacation. We hope to furnish an account in the next number.

The Debating Society closed its session in November after finishing the programme laid out by the energetic secretaries.

LIST

OF

Books, Journals, Bulletins &c., &c. in the Library

OF THE

Poona Agricultural College.

List of Books, Journals, Bulletins &c., &c. in the Library of the Poona Agricultural College.

POTATO.

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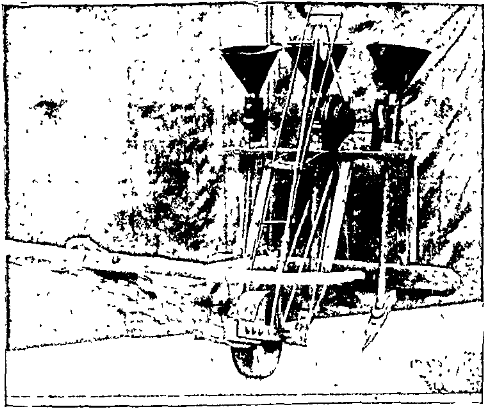

Joshi Seed drill (from Jamakhindi).
(First in Prize Competition).

The Poona Agricultural College Magazine.

Editorial.

THE present is the concluding number of Volume IV of the Poona Agricultural College Magazine. The volume is larger than any of those previously issued, and we do not think that the contents will be found inferior in interest or value to any of those which have preceded it. When we turn and consider the humble way in which we commenced four years ago, with the tentative issue of two half yearly parts, and now look at the large circulation which the magazine has reached and the amount and value of the contents we can hardly believe that the change has been effected in four years. The result is due, of course, to the way in which the college staff and past students have supported the venture and have placed their experience and observation at the disposal of the magazine, coupled with the energy and enthusiasm which the present students have given to its management we venture to hope that the high water mark is not yet reached, and that the ideal of the magazine-to be a high class agricultural magazine for Western India will be still more perfectly realised in future years.

The present number contains a number of specially interesting articles, and, as is always the case with the number issued in March is almost entirely composed of contribution from outsiders and past students. We would first of all draw attention to two articles on what may be called 'agricultural organisation'. The first of these, on 'Agricultural Associations in the Deccan' is by Mr. V. K. Kogekar, who has had unique opportunities of studying the subject and speaks out of the fulness of a very intimate knowledge of the subject. He has been for the past eighteen months organiser to the Deccan Agricultural Association, and his duties have been to travel about the country, visit local associations of every sort which exist, suggest to them lines of activity in which they could fruitfully spend their energies, and attempt to make such local associations of greater use that they have hitherto been

He has succeeded greatly in his efforts,—and has won golden opinions both from the local associations, and from the central body in Poona which has employed him His notes have, therefore, extreme value, as being the result of a first-hand and intimate knowledge of the subject. The second article on organisation is by an old friend, Mr. Udbyaver, the Auditor of co-operative credit societies in Southern Marath Country. He has in former days contributed a thoughtful and useful article on co-operation to our pages, - and his present notes will be found of considerable value and interest.

Closely related to the problems dealt with in the above two papers is that dealt with by Rao Sabeb G. K. Kotwal,—Cottage Industries under the conditions of dry land cultivation in Western India,—and by far the greater part of the cultivation is dry land cultivation,—a cultivator is bound to have a very large amount of time on his hands each year, and this would seem to give an opening for the developments of profitable byepaths of industry. Mr. Kotwal has made a study of a number of these. He has actually introduced *lac* cultivation, and one or two other industries by his own efforts,—and his paper will be found of extreme value.

Mr. Mahajan, the acting superintendent of Manjri Farm, writes on the method of testing the ripeness of sugar-cane. The use of the Brix saccharemeter is, of course, known in every country where sugar-cane growing and sugar making is practised on a large scale. It is not, however, in use at all in the Deccan—or even in Western India, and, it utilised as described by Mr. Mahajan we are confident will make an important step in the improvement of the very important industry of cane growing and *gul* manufacture in this part of India.

Other matters dealt with can be only mentioned. Mr Chibber continues his account of some plants likely to be of economic value with us · Mr. Beale one of our present students, who is specialising in Botany—gives an account of some of his own very interesting work on glands in plants : and there are others.

In sending out the last number of the present volume, brought out on the eve of the departure from the college of another generation of students, we can only wish to those who are leaving us the best that we know. May they by their high character, by their hard work wherever they may be called, by their energy, by their skill in applying to actual problems the information they have acquired and the methods they have learnt, worthily maintain the honourable traditions of the Poona Agricultural College.

Causes of the General Failure of the Oil Pressing Industry

IN

the Bombay Presidency.

BY

Kapilram K. Vakil, B. A., B. Sc. Tech. (Man.)

—:-0-:—

TILL recently the reputation of the oil pressing industry was very bad indeed, and failures were recorded everywhere. Company after Company was organised and several Oil Mills were started from time to time in Western India, but with the solitary exception of the Peeroo Mahomed Oil Mills Limited which worked successfully for 25 years, all proved failures. To-day capitalists and business men are not favourably disposed towards this industry and are in many quarters extremely hostile to the idea of establishing oil mills in the Bombay Presidency.

In 1902 Mr. F. G. Sly, the Inspector General of Agriculture, published a pamphlet on the Cotton Seed Oil Industry; since then the problem of the oil industry has occupied a prominent position. Two more publications of importance have since been made by the Government of India. In 1907 the question was discussed at the Indian Industrial Conference, and from 1905 a number of attempts have been made to organise this industry on a better scale. Two or three new companies were registered. At this time several articles were published in the Indian Trade Journal (Vol. VII) on the cotton seed oil industry. These articles created further interest among the public, and led to the formation of some more companies. Unfortunately all of them proved abortive. Thanks to the efforts of Prof. T. K. Gajjar, the pioneer of Chemical industries in Western India, and Mr. Ralph C. Whitneck, late Economic adviser to Gaekwar of Baroda, Mr. Fredric Noel-Paton, Director-General of Commercial Intelligence, and Dr. Harold H Mann. Public faith in the future of this industry has been maintained in spite of the above failures. Prof. T. K. Gajjar in 1909 himself projected the *Navsait Oil Manufacturing Company Limited* with a capital of Rs. 5,00,000. Part of the capital about Rs 150,000 was subscribed by the organisers and their friends, but the public had

lost all hopes in the commercial possibility of the oil industry in India, and no more shares were applied for, although every attempt was made to start the work of this Company. Finally the whole concern had to be wound up. Prof. Gajjar had also organised The Alembic Chemical Works Limited which received a satisfactory response from the public whilst his Navnit Oil Manufacturing Company project had to be abandoned. My efforts were, at the outset of my investigations, directed towards finding out the causes of failure of this industry in Western India. As far as I could judge, out of the various causes that determined the fate of the industry in its primary and experimental stage, the following may be given as the principal causes of failure.

I. At its very beginning, unfortunately, this industry received the attention of an adventurous class of men who had no special knowledge or experience of it Without proper expert guidance or experience they framed schemes with the help of machinery agents, who knew next to nothing about the chemical and economic side of the oil pressing industry and the consequences of whose ignorance had to be borne by the oil companies which were formed.

II. Acting under the advice purely of machinery agents the early companies started with an uneven distribution of capital, paying perhaps too much for the machinery and leaving too little for buildings, working capital, employment of chemical experts &c. In two instances in Gujerat we find that the concerns were started with a nominal capital of Rs. 100,000 each, of which only Rs. 60,000 were called. From this sum the machinery is reported to have cost as much as Rs. 50,000 for a plant to crush sixteen tons daily, leaving only a balance of about Rs. 10,000 for land, buildings, working capital, stores &c. Starting under such circumstances, however promising an industry may be, it is bound to fail.

III. As the natural consequence of the above, in seven cases of ten, the Mills had to be mortgaged from the very beginning, and if the originators and promoters did not possess sufficient influence they had no facilities even to borrow money to meet working expenses. Special stress must be laid on this point.

IV. Mr. P. R. Chaudhri of Calcutta in his paper on 'Oils and Oil Seeds,' read before the Third Indian Industrial Conference drew our attention to other features; he remarks, "It was also then that I came to know of the deplorable *shortsighted policy* of these mill-

owners, the faulty economic basis on which some of the mills were managed and to some extent, the regrettable want of honesty." Dr. Lewkowitsch in his speech before the Indian Guild of science and Technology similarly remarks: "As another example, I might point to the industry of *Edible Cotton seed oil*. India, as you know, produces an enormous amount of cotton seed. The bulk of this is shipped to Europe to be worked up there into oil and cake. This industry should be retained in India and an important industry might be created, if it were taken up in India in the proper manner. In Bombay actually some mills have been started; but look at the way in which this has been taken up by these apparently enterprising people in Bombay. They first thought of the edible cotton seed oil industry in the United States of America, and because the Americans were successful they thought that all they required to do was to send out a commission to look at the American Mills and to place an order for a large plant in America. Then the thing should work by itself. *Unfortunately they overlooked the fact that the individuality of the Indian cotton seed ought to be studied*; naturally failure was bound to come, as indeed it did come."

V. Some of the Oil Mills are equipped at random with Machinery suited to crush other varieties of seeds than their own particular requirement. I lately visited a concern which though established for crushing cotton seed did not possess a single piece of machinery that is required for the special treatment of this seed while they had a regular plant for treatment of castor and other seeds I have seen this instance even pointed out in a confidential Government report, on the subject. In some other cases I was surprised to find that mills were equipped with old or rejected machinery brought from England or elsewhere. In the case of a Bombay mill, which of course ultimately failed, I was told that the management had scarcely a day passed without some mishap or the other happening to the machinery.

VI. There has been considerable ignorance as to the proper treatment of oil seeds and oils, and no small amount of difficulty was experienced in treating and refining the oils. At one of the mills I visited, when they were crushing castor seed, and did not, for some reason or another, get the proper colour and the peculiar florescence of the crude oil, they tried to remedy this defect by putting in the Edge-runner a quantity of some harmless colouring material (turmeric) with the result that the merchants refused to buy both the oil and cakes worth about Rs. 20,000.

VII. During the monsoon and to some extent in other seasons, it is very difficult to store cakes, as they soon go mouldy and get heated up. Thus they get considerably deteriorated in value, where proper measures are not adopted for their preservation.

VIII. There is a very small local demand for cakes, and most of the cake is exported. This export business can only be paying if it is placed in the hands of reliable men, as we have to deal with a distant and unknown market.

IX. Rail and shipping charge of oil and cakes being very high some of the mills located at long distances from market or shipping port found financially impossible to bring both the oil and the oil cakes to Bombay which is their chief market. In Broach, Baroda and other towns the faith of the people in the cakes and oil pressed in the native ghanis make it difficult for the machine pressed cake and oil to find buyers locally.

X. Again in places like Broach &c. seeds were not available in large quantities all the year round and they had to buy from the Bombay market. Thus they had to pay rail charges both on the raw materials and on the oils and cakes, for ultimately the whole output had to be consigned to Bombay.

XI. As regards the exports of oils, there is considerable difference of opinion, but the majority of them are convinced as to the non-paying character of the export trade. Dr. Harold H. Mann and others inform me that the expórt trade in oils at present is not paying and any attempts to do so have met with failures. Five reasons for which are given.

I. High freight on oils.

II High price of casks.

III. Loss by leakage.

IV. Loss by absorption.

V. Gross adulteration of exported oils by earlier shippers. I am convinced that unless we can ship our oils in bulk as mineral oils there are very few chances of success in that direction.

As regards the loss by leakage and absorption I am informed by Messrs. Ransom and Company of London that if the casks are silicated

or glued from inside these losses can be minimised. The English and continental buyers do not like to buy Indian oils on account of the gross adulterations that were practised by early shippers. *It being easier to detect bad quality of seeds than an adulterated* oil they prefer to buy seeds and not oils

XII. The Indian farmer and cattle owners refuse to buy machine-made cakes for fodder as the percentage of oil in the country *oil cakes is greater than in the mill cakes* Though the percentage of oil in mill cakes is less, it is erroneous to suppose that these cakes are poorer in quality as feeding stuffs All the same it is very difficult to fight against this prejudice of the farmers and we have to face the situation as it is.

XIII. As the export trade in oil was, in the opinion of many, a non-paying business and as there was a very small demand for cakes it was found that the extension of the oil pressing industry was limited to the local demand for oils for edible purposes and as lubricant. The *Indian bullock oil presses supplied edible oils and there was very little* demand for the oils obtained by machinery. In fact the supply increased more than the demand and as there are no industries depending upon the utilization of oils, *e. g.*, soaps, candles, margarine &c. the newly started oil mills worked spasmodically and consequently were *commercial failures.*

XIV. Another serious cause of failure was found in the growing demand of mineral oils for burning purposes. Till the beginning of this century large quantities of vegetable oil were used for this purpose, but as these oils were dearer than the mineral oils their consumption was seriously checked.

XV. On the one hand without proper knowledge and special experience the oil crushing industry was *presenting inexplicable difficulties* to the native Indian merchant, and on the other hand, shipping and financing facilities for the exportation of the raw material namely oil seeds themselves acted as a powerful inducement to our merchants and this brought about a further neglect of the otherwise important oil crushing industry. Special emphasis must here be laid on the detrimental effect produced by prolonged storage of seeds and cakes in this country. It was always found safe to send them out of India, as early as possible. Seeds stored in the warehouses of the mills had considerably deteriorated and were found in many cases unfit for pressing purposes. Before

concluding this short paper I must mention here the particular case of the cotton seed oil industry. In its very beginning it had lamentably failed as failure was bound to come. There was no technical guidance, no lucrative market for machine pressed oils and the products like hulls, cakes &c. Demand had to be created and in doing so reverses had to be encountered. Then character of the seeds had to be studied and the refining processes had to be perfected This was only possible if the experiment had been financially supported. Messrs. Tata Sons and Company are to be specially congratulated on taking up this industry in the right and proper spirit and it is hoped that their experience will work as a valuable asset for the future of this industry in India. The Indian Cotton Oil Mill Company Ltd. of Navsari is also to be congratulated on having successfully terminated their experimental stage and on their desire and effort to place their Company on a sounder basis by increasing their original capital. Having taken into consideration the prominent causes of failure, I am optimistic as regards the future of this industry, and given technological skill, bonafide workers, facilities for commercial undertaking and organisation on right lines, there is no reason why this industry should fail, if the Government and the people continue in their efforts, as directed at present to develop, and promote this industry. I am sure we shall soon put a serious check on one of the greatest drains of raw materials from India, and establish a staple industry which by right would belong to us in the future. New works for the manufacture of soap, stearine, glycerine and candle are started, and lubricants, boiled oils and other oils of technical importance are now made in large quantities in India, and there are now sufficient indications to show that we have passed through the experimental stage, and all the local conditions appear favourable for the founding of this industry on a large scale, and if we direct our future efforts wisely by our experiences of the past we shall have little cause to fear further failure.

Some Experience of Artificial Manures in the Karnatak.

BY

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IN the Karnatak cattle dung is practically the only return that is made to the land in some form of farm-yard manure. The dung is often mixed with pieces of *kadbi* in varying proportion and allowed to rot for some time before it is applied. A liberal admixture of earth, stones and refuse is not uncommon to meet the increased demand in recent years. The use of manure on the whole, is making good progress in the Karnatak. The majority of the *raiyats* now know very well the advantages of different manures, and they generally do not fail to apply the right kind to their field if they can. But unfortunately the number of cattle in the country is decreasing. The price of ordinary bullocks has much increased and their maintenance has become very difficult on account of the high price of fodder. Under these circumstances it is not surprising to see a good many cultivators managing their work with hired bullocks whenever necessary. All such persons have to purchase their whole supply of manure from the neighbouring *raiyats* usually at a high rate or remain content with what their impoverished soil returns them for their labour.

The results of manure are often imperceptible in dry farming which is precarious on account of the uncertain conditions of rain fall. Excessive heat and aeration lead to the production from the rocky particles of the soil a good deal of plant food, which if there is no heavy rain to wash it out, continues to accumulate so as to support the growth of crops in a very remarkable manner under favourable conditions. But the state of things is different in irrigation farming. Constant application of water alone is sufficient to wash out the greater part of the fertilising value of the soil, necessitating thus the application of manure

in sufficiently large quantity before the land is again cropped. Even the crops which require the least manure do not give profitable results without manure. The cultivation of sugarcane and other paying crops would be therefore impossible if the land is not well stocked with manure. The cane growers of the Gokak Canal tract usually manure their crop with one hundred cart loads of farm-yard manure per acre in addition to folding sheep on the land. In this as well as in other irrigated tracts there will be naturally a good demand for manure and consequently the cultivators will have to go outside their own neighbourhood in search of it, undergoing thus a lot of trouble and the expense of carting the stuff to their fields, apart from the cost of manure. With all this they are not always fortunate in their bargain. They often find *that their article is too poor to produce the estimated outturn.* *The* composition of farm-yard manure is very varying depending on a number of factors. To add to these, the heaps they purchase contain a lot of useless material purposely worked into them.

Working under these various difficulties the *raiyats* in any part will ever remain under great obligation if their manurial problem is either solved or simplified. The efforts of the Agricultural Department to popularise poudrette and to introduce oil cakes seem to be credited with success. Experiments with various artificial manures are being conducted on many of the Government farms and elsewhere, and a desire has been created in the mind of some well-to-do land owners to give a trial to them.

But unfortunately the results with artificial manures are not quite satisfactory although their use is generally attended with considerable profit in other countries. The application of inorganic manures does not seem to add to the fertility of the black cotton soil. The fact that these soils are much benefited by the addition of cotton refuse and town sweepings (which generally contain only a trace of plant food) demonstrates the necessity of improving their mechanical condition by giving a sufficiently large dose of some bulky manure rather than to concentrate their inorganic contents by the mixing of artificials. Experience has further shown that the results obtained with artificial manures on the Dharwar farm are to a great extent inconclusive or inappreciable.

The following statements show the effects of various manures on the yield and cost of production of the two important crops, *viz.* cotton and jowar.

Statement No. I showing the results of artificial manures on Cotton.

No.	Crop.	Manure.	Quantity per acre.	Cost of manure.		Yield of Kapas per acre (average of original and duplicate plots) in 1908-09	1909-10	1910-11	1911-12	Average yield of Kapas per.	Remarks.
			lbs.	Rs	A						
1.	Cotton	Sodium Nitrate.	63	6	5	558	597	518	240	473	The manures are applied at the rate of 10 lbs. of Nitrogen per acre in two equal dressings half at the time of sowing and half six weeks later.
2.	"	Calcium Nitrate.	92	9	3	543	528	499	242	453	
3.	"	No Manure.	Nil.		0	499	588	538	278	476	
4.	"	Farm-Yard Manure.	2000		2	571	598	550	248	492	
5.	"	Ammonium Sulphate.	48	4	13	571	585	442	231	457	
6.	"	Calcium Cyanamide	66	8	4	616	618	568	263	514	
7.	"	Nitro.	85	10	10	599	601	472	203	491	

N. B.—Every plot receives 2 tons of farm-yard manure per acre in addition to the above quantities.

Statement No. II showing the results of artificial manures on Cotton.

No.	Crop.	Manure.	Quantity per acre.	Cost of the manure.	Yield of Kapas per acre in 1908-09	1910-11	1911-12	Average yield per acre.	Remarks.
			lbs	Rs A.P.					
1.	Cotton	Super Phosphate	300	9 6	288	320	318	309	
2.	,,	Potassium Sulphate	100	8 5 4	327	356	316	333	
3.	,,	Ammonium Sulphate	100	10 0 0	251	298	302	284	
4.	,,	No Manure.	Nil.	...	356	528	297	394	
5.	,,	Super. $K_2 SO_4$	300–100	17 11 4	282	316	310	302	
6.	,,	Super $Am_2 SO_4$	300–100	19 6	196	296	320	273	
7.	,,	$K_2 SO_4$ $Am_2 SO_4$	100–100	18 5 4	286	297	281	287	
8.	,,	$Am_2 SO_4$ Super $K_2 SO_4$	100–300–100	27 11 4	106	286	300	231	

Statement No. III showing the results of artificial manures on Jowar :—

No.	Crop.	Kind of Manure.	Quantity per acre.	Cost of the manure			Yield of grain per acre (average of original and duplicate plots)				Per acre Average yield of grain	Yield of *Kadbi* per acre (average of original and duplicate plots).				Average yield of *Kadbi* per acre.
				Rs	As	P.	1908-09	1909-10	1910-11	1911-12	lbs	1908-09	1909-10	1910-11	1911-12	
1	Jowar	Sodium Nitrate ...	10 lbs of N 63 lbs.	6	5	...	1371	1112	664	615	940	3370	2830	2780	1650	2657
2	"	Calcium Nitrate ..	92	9	3	..	1434	1115	661	601	953	3750	3180	2600	1648	2794
3	"	No manure ...	Nil	...	...	...	1255	995	611	576	864	3050	2500	1800	1660	2252
4	"	Farm-yard manure ...	2000 lbs	2	...	...	1231	1030	631	583	866	3150	2620	1875	1740	2346
5	"	Ammonium Sulphate ...	48	4	13	...	1296	993	726	590	901	3150	2590	2360	1625	2431
6	"	Calcium Cyanamide ...	66	8	4	...	1223	1003	694	623	886	2750	2580	2750	1725	2451
7	"	Nitre ...	85	10	10	...	1350	1168	640	638	949	2930	4020	2320	1650	2755

N. B.—The manures were applied in two equal dressings half at the time of sowing and half six weeks later.

From the figures of yield in Statement No. I, it will be seen that the farm-yard manure is second to Calcium cyanamide which on an average has produced 22 lbs. more of *kapas* at an increased cost of Rs. 6-4-0 per acre. Thus there is on the whole a loss of at least Rs. 2/- in the nett profit per acre of the plot treated with Calcium cyanamide as 22 lbs. can only fetch Rs. 4/- at the most. The use of other artificial manures is not promising as their average outturn is below that of farm-yard manure and their cost (in all cases) higher than the latter.

In Statement No. II the average yield of no manure plot tops the list. But there is an indication that if the experiment is repeated for some years more the yield of no manure plot will rapidly decrease and artificial manures may in that case show favourable results. Even then it is to be seen whether the increase in yield will be proportionate to the cost.

In the case of *jowar* the results are not so discouraging. The application of artificial manures has resulted in more or less increased outturn of both grain and *kadbi*. But the increase in all cases is not sufficient to give a corresponding gain in the nett profit.

Now turning to other crops potato and sugarcane whose manurial requirements are generally supplied by the cultivators in large bulk we arrive at nearly the same conclusions.

The following statements summarize the results obtained in the case of these two crops :—

Statement No. IV showing the results of artificial manures on Potato at Belgaum.

No.	Crop.	Manure.	Quantity per acre.	Cost of the manure.	Yield of tuber per acre 1909-10	10-11.	Average.	Remarks.
				Rs A. P.	lbs	lbs.	lbs.	
	Potato.	Farm-yard manure	15 cart loads	15 0 0	14350	16700	15525	
		Farm yard $Am_2 SO_4$	9 carts 1 cwt.	20 2 0	13040	16760	14900	
		Farm $Am_2 SO_4$ $K_2 SO_4$	9 carts 1 cwt. 1 cwt	29 7 4	12120	16630	14375	
		Farm $Am_2 SO_4$ super	9 carts 1 cwt 1 cwt.	23 10 0	12930	17110	15020	
		Farm super $K_2 SO_4$	9 carts 1 cwt 1 cwt.	23 10 0	12020	16430	14225	

N. B.—Farm-yard manure was applied in May while the artificials were applied in November at the time of planting.

No.	Crop.	Kind of manure.	Quantity per acre	Cost of the manure			Yield of gul per acre average of orig and duplicate plots in		Average yield per acre for 2 years	Value of the average out-turn per acre			Increased value over Farm yard per acre.			Increased net profit over Farm yard.			
				Rs	As.	P	1910-11 lbs	1911-12 lbs	lbs.										
1	Sugar cane	Farm yard ...	20000 lbs. + nil	26	12	4	7490	5125	6307	450	8	..	...	...	...	...	..	...	
2	"	Fym + Safflower cake	20,000 + 150 lbs of N	72	3	10	9285	6846	8065	576	...	...	126	..	...	80	12	6	gain.
3	"	Fym + Saff cake + Am_2 SO_4 ..	20,000 lbs + 75 lbs. of N + 75 lbs. of N	85	7	6	7910	6825	7367	526	4	...	76	4	...	17	12	10	gain.
4	"	Fym + Am_2 SO_4	20,000 lbs. + 150 lbs. of N	98	12	...	8585	6815	7700	530	...	...	100	...	...	28	0	4	gain.
5	"	Fym + Am_2 SO_4 + K_2SO_4	20,000 lbs. + 150 lbs of N + 150 lbs. of potash	144	11	10	8970	6100	7035	502	...	...	52	8	...	65	7	6	loss.

N. B.—Farm yard manure was applied before planting while the artificials were top dressed at the time or earthing up the crop.

Both the crops were irrigated. Potato was given well irrigation while sugarcane received canal water. In the case of potatoes the average outturn of tubers is highest on the plot treated with farm-yard manure. The application of artificial manures has not resulted in the increase of yield. Besides the cost of these manures is higher than farm yard manure thus making the concern on the whole a losing one.

The top dressing of sugarcane with artificials has resulted not only in the increase of *gul* but also in the increase of nett profit. Safflower cake however seems to be the best manure in this particular case. The results with ammonium sulphate either alone or in conjunction with safflower cake are encouraging where as ammonium sulphate in addition to potassium sulphate does not seem to have profitted the crop in any way.

It is however too early to conclude anything definite, many of the experiments being still in their infancy. The difference in the previous treatment of the plots which shows itself for many years often spoils the whole thing. The results therefore are not quite reliable unless they are repeated a number of times. Again when the washing of plant food especially nitrogen, and the rise of alkali, in irrigation, are taken into consideration, farm-yard manure seems to retain its present position as it remedies both these evils by being slow in action and diluent in bulk.

Agricultural Co-operation Abroad.

BY

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IN India, the agricultural conditions are severe: the pressure of population and of foreign competition renders it necessary to cultivate land as thoroughly as science and art can devise, and yet as cheaply as good business arrangements can secure. All sorts of panaceas have been proposed, but the only available one is that which is but partially tried, *viz.*, self-help. The difficulty is as to how this remedy is to be developed and applied; the cultivator is in need of capital, of experience, of initiative, of self-reliance; the more intelligent or richer proprietors stand afar off. It is in co-operative associations of the various classes that the true agricultural remedy is to be found. There will be in my mind, one remedy but diverse applications of it. It will be necessary to assist in the supply of credit, the development of knowledge, the stimulation towards new departures, the *re-approachment* of classes, education in wider ideas and in business-like habits. So far as India is concerned, it is not unusual to excuse the present condition of things by saying that agricultural co-operation in any approach to a wide-spread and practical system is absolutely in its infancy; that Indian agriculturists are ignorant and indebted, suspicious and conservative and that it is impossible to organise them in any kind of associations on account of their utter individualism. But a glance at the economic history of almost all European countries will show that in every one of them similar, nay even worse, conditions prevailed only thirty years ago, and that the way in which all these countries overcame the disadvantages of their position, and boldly met and were made only the stronger by adverse circumstances, needs special study on the part of every one interested in the welfare of India.

Since the peasants became the leaders of the associated movement in Denmark, they have imparted a new spirit to its development in the course of a few years; the peasants have established a co-operative organisation which has won the admiration of the whole world and

raised agriculture to such a high technical level that large business concerns are left far behind, or have only recently begun to follow. "Reduced to the proportions of a dwarf," says *E. A. Pratts in his* book 'Organisation of Agriculture' Denmark fought against adversity with the courage of a giant; and, crippled though she was, she not only regained her strength, but became a power in the commercial world with which other nations have had seriously to reckon. What with *her very practical and comprehensive system of* agricultural education, her elaborate development of an easy and most effective agricultural credit, and, finally, her great variety of agricultural co-operative associations, Germany may well claim to have reorganised the position of *the cultivators of her soil in a way that has brought to them a measure* of success, and to herself a degree of economic advantage, that would have been impossible if, when they were threatened with agricultural depression, they had clung tenaciously to old ideas and antiquated methods. Count de Rocquigny of France writing in 1884 says—"It was necessary to organise for the (economic) struggle, to realise promptly all the possible opportunities for progress, to decrease the cost of production, and to improve the methods alike of production and of sale. For the attainment of these ends the old agricultural associations were *but ill-prepared. It no longer sufficed merely to spread technical know*ledge and to give prizes and awards to agriculturists at periodical exhibitions". The co-operative movement in Belgium has hardly yet developed, and already the agrarian crisis has moderated and in some *parts of the country it has already come to an end. There is, in fact* a real awakening of agriculture. Experience has already shown the value of such institutions. The peasants found that they could buy, at lower prices, products of a superior quality, guaranteed by trustworthy analyses against fraud. The soil began to produce abundant harvests; the cattle, better nourished, improved in quality and gave a richer milk. Confidence in the future revived many hitherto-discouraged cultivators. The peasants of Italy were, perhaps, even worse fitted than those of most of other countries of Western Europe to meet the agricultural crisis when hundreds of peasants were being sold up for non-payment of debts which often did not even exceed five or six shillings in amount; when more and more land was going out of cultivation; when the ranks of the unemployed in the towns were being swollen by constant accessions from the rural districts; when emigration went on at a greater rate than ever and when Italy seemed to be ill-equipped, indeed to meet the coming economic struggle for the markets of the world. *But as to the accomplished results in Italy*, though the movement is of comparatively recent growth, and the full development *thereof* has still

to be attained, the agricultural revival has been spoken of as a 'resurrection, and there is, indeed abundant evidence that from both a material and a moral standpoint the outcome of the movement has already had a most powerful influence for good. Materially, the decentralisation of capital which has saved the Italian agriculturist from the money-lender, and placed an easy credit within his reach, has, in the first place, led to a greater amount of land being brought under cultivation. Then the increase in the extent in the land cultivated has been followed by an increase per acre in the yield therefrom, owing to the greater use of fertilisers, machinery &c. as encouraged alike by the spread of agricultural instruction and by the facilities offered, in regard to purchase, by the agricultural societies. The quality of the stock has improved, agricultural industries are affording new openings to energy and enterprise, and the whole agricultural position has undergone an improvement that is little short of marvellous, considering how recently it was that the Italian peasantry found themselves faced by some of the *severest forms of economic depression that any country could be called* upon to meet. Morally, too, the effect has been great and none the less striking. The movement has established confidence and kindly feeling between conflicting elements; has made illiterates to learn to write. To be rescued from the grasp of the usurer was in itself almost a revolution, which was completed by the spirit of independence and of self-reliance and other moral qualities which association fosters. All these and the various other conditions following from fraternal association have had their reflex action on village life in Italy, investing it with interests and possibilities hitherto undreamed of, and filling the peasants with new hope and trust in the future.

Similar accounts may be given of almost every one of the countries of Europe, but it is unnecessary. Japan, too, following in the footsteps of these countries, and eager to benefit by their experiences, has readily adopted and put into practice the conviction that, if agriculture is to prosper, it must be by means of effective organisation, conducted along lines suited to local conditions and requirements, and 'founded primarily on a happy combination of State-aid and active self-help. In India, itself, the movement has shown a life and vigour which, looking to its young stage, has never before been witnessed in this particular movement within such a short space of eight years of its birth. The progress made is quite phenomenal, such as has nowhere else been previously known. The movement has not, however, yet begun in other and more important spheres of agricultural co-operation and the

credit movement may be said to have only touched the hem of economic life of this great and populous Empire.

The report submitted in 1896 by the Parliamentary Recess Committee for Ireland, of which the Right Hon'ble Sir Horace Plunkett, M. P., was chairman, positively declared that the investigations of experts into the co-operative movement on the continent of Europe have borne proof to the fact that eight of the countries there have found by practical experience that agriculture cannot be made productive without being wedded to co-operation". Co-operation has been described by a great authority as the "German farmers' stronghold and bulwark". "And the more I inquired the more I was met by this striking fact" says Mr. Pratt, in his invaluable book-the Organisation of Agriculture, "that in every one of the countries (of Europe) there has been an agricultural revival which has led to the spreading throughout each of them of a more or less complete network of agricultural organisation, manifesting itself, in varying degrees, in the spread of agricultural education, and in combinations among the agricultural community for an endless variety of purposes, including the virtual transformation of farming methods in accordance with the latest developments of agricultural science; organisations for obtaining agricultural necessaries of reliable qualities at lesser cost; the purchase in common of costly machinery which would otherwise be beyond the means of a small cultivator; the formation of co operative societies for purposes both of production and of sale; the setting up of agricultural credit banks as a means of keeping the farmer out of the hands of the usurer, and enabling him to carry on his operations more successfully; and the improvement of the individual lot of the agriculturist in many different ways".

Nearly all civilized countries of the world have since recognised that only permanent remedy for agricultural depression and the only true solution of the industrial problem which is involved is to be found in co-operation. The latest inquiries instituted by the International Co-operative Alliance into the various methods adopted by the agriculturists to improve the condition of their industry have further elicited the fact that in nearly all countries, including Great Britain, co-operative methods, in some form or other, have been employed to meet the requirements of the agriculturists. It is therefore necessary to examine these co-operative methods and to find out how far their growth has been co-extensive with certain broad changes in the methods and nature of agriculture.

Agricultural organisation resolves itself primarily into four essential factors —I. Co-operative Societies, II. Co-operative Associations, III. Agricultural and Co operative Education, and IV. State-Aid.

It will be subsequently shown that the history of agricultural co-operation in all the countries of Europe shows that, in order to attain success, all these four factors are equally necessary and that where one of them is lacking, there the movement has not made rapid and thorough progress much less attained perfection. Co-operative societies and associations have no doubt extended their sway over all classes of people to the unspeakable benefit of their material and moral position Education, however as a means of leading the mass of people to understand and value co-operation as an educating, emancipating, stimulating and moralizing factor, and of bringing up the growing generation with a knowledge of the social and economic significance of the various kinds of associations; and State-aid, as a means of stimulating co-operation, promoting the formation of co-operative societies, furthering their development, and vivifying private enterprise are necessarily wanted. They are not open to any tenable objection as they have been resorted to by all the countries, including Great Britain, irrespective of their relative differences and Stages of civilization.

These Societies can be divided grossly into four main heads .—

I. The Agricultural Bank, more commonly known as "a rural co-operative credit society," conveys to the agriculturist the money which he requires for the purchase and improvement of his land; for the purchase of cattle, seed, or manure; for redeeming old debts; for the payment of rent, assessment and legal expenses; and for meeting his various kinds of household expenses and petty luxuries.

II. The Supply Society is intimately connected with the credit society being in most cases structurally similar; but with this distinction that while the latter supplies cash, the former supplies agricultural materials.

III. The Productive Society is composed of agricultural producers combined together for the purpose of joint production. But this society may cover not only the supply and the sale society but also the credit society.

IV. The Sale Society is composed of farmers or federated societies for the common storage and transport of agricultural produce;

for finding the best markets; and for securing the most advantageous terms on Railways or Steamers.

There are also some miscellaneous types such as Cattle Breeding Societies, Crop and Cattle Insurance Societies and such others. The Society for the improvement of breeds of animals apply the co-operative principle in their own special way by issuing herd-books, selecting sires, paying careful attention to breeding, organising competitive shows, special markets etc. The crop and cattle Insurance societies are meant for insuring crops against drought, floods, hail, excessive rain, insect pests &c.; and for insuring cattle against diseases and death

The Co-operative Credit Societies —The history of rural economy alike in Europe, America and India has no lesson more distinct than this that agricultural classes are in a state of extreme indebtedness due not so much to usury as to causes outside the demands of agriculture, such as poverty, ignorance, seasonal disasters and epidemic disease. Neither the condition of the country, nor the nature of the land tenures, nor the position of the agriculturists affects the one great fact that they must borrow. Still more then is the small farmer of India under the necessity of borrowing. For centuries harassed by wars, misrule, and holding petty areas of often unimproved land; compelled by his tenure as proprietor to expend his capital in the purchase of land usually at competition rates (or failing to purchase land, to hide his capital underground); owing to the insecurity of the moveable property menaced by thugs and decoits and often by their own plunder-loving predatory chiefs; harassed by seasonal disasters hardly exceeded even in Europe, such as drought, floods and excessive rain, cattle diseases, insect pests and blights, must he borrow and borrow freely and heavily, annually and continuously. This indebtedness is recognised in Europe as a position of danger and every country is seeking its remedy in the direction of organised credit. The credit society is therefore considered to be an indispensable necessity. It is found that in Germany, its birth place, it came first in the movement, and that when the credit organisation was complete the other organisations came in the sequel. Germany is verily the model country for co-operative credit and in Germany the co-operative credit association has been the parent of every other form of co-operation. The study of agricultural credit includes the study of the whole of agricultural organisation. Agricultural credit there means to different things-the credit which is built upon the village bank of individual farmers and the credit which starts from those same men organised into a society for the supply, production, and disposal of agricultural commodities.

Supply Society :—A Credit Society no doubt frees the farmer from usury in money, but it cannot free him from usury in price. Alike in the supply of seed, manure and cattle, and in the disposal of their crops, the farmers have to suffer a loss of from 25 to 50%. No mere change in the machinery of credit, therefore, can of itself effect a radical cure; it can, *per se*, only palliate the symptoms or retard the catastrophe.

In economic parlance, agriculture obeys the law of diminishing returns, while manufacture the law of increasing returns; farming is a question of labour, manufacture a question of machinery; farming is a non-specialised occupation, manufacture is a combination of minutely divided processes. But co-operation and agricultural science have changed these conditions. Agricultural geology and chemistry have together proved that the point of diminishing returns can under scientific treatment be postponed, and that the limit of this postponement must be ensured by the application of 'co-operation'. Earlier economists regarded the soil as having a natural fertility the gift of Providence to be taken or left. When Nature stopped Man could not move, save at a quickly increasing disadvantage. But now, a field is no longer the bounty of Nature, but is built up by Man as much as is a wall, composed of materials that are continually being rearranged and reinforced by manures and chemicals brought from foreign places. Not only is land made good, more abundant and more steadily fertile, but fallow lands and soils confined to a low state of cultivation have been made first class by certain products-Lucerne and vegetables which contribute Nitrogen. Thus, lands which were formerly a dead loss to the owner have been made rich and profitable. Formerly a farmer trusted to Nature to refresh the tired land by leaving it fallow once in three years. Now, he himself replenishes it by the application of chemicals and the scientific rotation of crops. Again, the wooden plough has been replaced by the iron plough with triple shares of steel moved by electricity and steam, instead of animal power. Manure distributors and sowers spread manure and seed more regularly and evenly, and thoroughly and quickly, than is possible by hand; binding and reaping machines reap the crop in much less time, speed being invaluable in the ingathering of the harvest. Rain water had been the chief source of water till fifty years ago and it was not surprising that the richest lands on the banks of the biggest rivers were suffering from the effects of drought, when the river water raised with a little effort could have procured a golden harvest. But now, by means of steam pump and

irrigation and canals, fields, not only those bordering the rivers but also those hundreds of miles distant from them, are being watered.

Thus, in the matters of preliminary preparation of the soil, of machinery and of specialisation of work, agriculture within limits is approximating towards industry. As regards the changes, co-operation is the instrument which has enabled the small farmer to come into line with modern methods. It is the supply society which has provided the small farmer with artificial manures, best seeds and cattle; it is the supply society that has equipped him with modern machinery and other improved appliances; it is the supply society aided by the productive and sale societies, in fact the whole network of co-operation which have educated the small farmer up to the use of these new things and helped to make him what he now is no longer a slave but a master of Nature.

The Productive Societies.—Agriculture is the first industry in this country and its prosperity has the greatest direct influence upon conditions affecting the national welfare. Agriculture supports twenty crores of our people and the gross produce from the land is about 450 crores of rupees or $22\frac{1}{2}$ Rs per head per annum. Some estimate it at Rs. 40 and some at Rs 20. Whatever it may be, it is true that the crop yield per acre in India is the lowest in the world, which owing to the ignorance and indebtedness of the peasant is declining still further, and the exhaustion of the soil is fast proceeding. Again $104\frac{1}{2}$ million acres of culturable land are lying waste for centuries as against 207 millions under cultivation. If only 50 % of the present produce were to be increased and only 25% of the present culturable waste land were to be reclaimed, we could get 900 crores of rupees as the gross produce thus obtaining the proverbial two blades!

Accepting the fact that the productive processes concerned must be conducted on modern lines, co-operation alone enables the small farmer to be at once a small farmer and a partner in a big industrial concern. The scientific system of agriculture is feasible only if undertaken by capitalist farmers who can afford to commence farming on a large scale. For the scientific method of agricultural production at least a hundred acres are necessary to make provision for sufficient water, good manure, selected seed, greater division of labour, the opportunity of raising particular crops according to the suitability of land, greater rotation of crops and greater scope for experiments. And co-operation alone can procure a small farmer all these advantages; a small farmer added to another small farmer makes a large farmer. To those may be added

the advantage possessed by the farmer who works on his own account, *viz.* the intense interest taken by the cultivator in his work, the spirit of independence and of self-reliance and other moral qualities which co-operation fosters, as also the social influence which it confers on the possessor of land.

The productive societies are much more complex in their constitution than those previously considered, and include the credit society as well as the supply society and may involve the sale society also. But these societies can be worked with ease and simplicity in reclaiming waste lands which in Bombay Presidency amount to about 14 ½ *lacs* of acres. These societies require a large amount of capital to purchase land, to repair fields, to construct canals, to dam rivers or brooks, to purchase improved implements, to build houses for farmers, to purchase seed manure and cattle, to build storehouses and cattle sheds, to purchase field machinery for pumping water, ploughing, sowing, binding, reaping, threshing and for several other purposes; to purchase farm macninery such as chaff cutting, grinding, crushing, winnowing, pounding and so on. Again, the farmers might want loans for marriage expenses; for paying assessment and landlords' rent; for redeeming old debts; and for several other household purposes, for which capital is also necessary. Thus the society might carry on the functions of a credit society. Further, the society might have kept a stock of ploughs, or maintained a good breed of cattle, or stored seed and manure, and it might loan out any or all of these articles to their farmers, the value being extinguishable from their wages or other earnings. The society might also instal a pumping engine and might supply water at so much per hour. These operations appertain to the supply society.

Again, a society of sugarcane growers might require a sugar factory for manufacturing sugar; a cotton growers' society might require a gin or a press for ginning their cotton and pressing it into bales for transport; a wheat growers' society might require a grinding mill for manufacturing and exporting flour; or a paddy growers' society might require a rice hulling factory, for separating the husk, for cleaning and pounding the rice and so on. And thus export their respective goods at a cheaper cost and obtain better prices for their commodities than they would have otherwise done. Thus, this same society might take up the functions of a sale society in the matter of transformation of the produce of the soil and transmission of the same to distant markets for sale.

For agricultural production India possesses great natural advantages which when fully utilised, will surely add greatly to the wealth of the

country. Agricultural production, on scientific lines, is important not only in itself, but on it are based all possibilities of the development of manufacturing industries.

Sale Societies :—The problems of a sale society vary according to the nature of the commodity to be sold. The articles of immediate consumption such as fruits, eggs, milk, and flesh require a close knit organisation to arrange for a speedy transport. But the commodities like corn, flax, cotton, or preserves of fruits &c., owing to the variations in the harvests and the presence of foreign supplies involve a highly specialised and speculative business demanding in a co-operative organisation an expert and locally supported directorate. Again, a farmer may produce his crops primarily for local consumption or primarily for a foreign market Rice, jowar, bajri, sugar and *gur* are examples of the former kind, while cotton, tea coffee, oils, seeds, jute and coir are of the latter. No agriculture can be really productive which is divorced from a neighbouring non-agricultural market, represented by thriving towns and cities. In the absence of such a market near the next available substitute is a large export trade to distant markets or to foreign countries; but the latter cannot fully take the place of the former. Now, internal trade is of two kinds—traffic with the ports, and commerce with the different parts of the country. For the growth of trade and commerce the development of the means of rapid and cheap transportation is essential. Railways now connect all the principal districts and cities, the great rivers have been bridged, the country has been covered with roads, and the rivers and canals afford increasing facilities for transport. Steamship communication has been developed in those parts where the rivers are navigable. The canals also offer some facilities of communication and transport. It is however in maritime transport that the greatest development has taken place.

Now comes the vexed question of Railway and Steamer rates which is felt by many to underlie all projects for the revival of agriculture. For some years, no doubt, the Railway rates in India are steadily on the increase, but the Railways have special rates for full wagons or train loads which the large companies like Ralli Brothers are now enjoying and which is possible for the small farmers to obtain by combination; thus saving considerable sums (even 25%) by arranging for the despatch and receipt of larger and more regular consignments. The readers of that invaluable book "The Organisation of Agriculture" by E. A. Pratt need not be told that the sole effort and aim of that book is to show how this has been done in all different continental countries

of Europe. He says "The agriculturist abroad is not a mere unit (as he is in this country) but a member of a highly and skilfully organised combination which could not only dispose of its production in big loads but was also able to purchase its necessaries of life in such large amounts as to secure a substantial reduction alike in their cost and in Railway rates for their transportation. The greatest degree of success has been obtained where the associations have been started on a very small scale in rural districts to meet local, or even strictly parochial conditions, and while maintaining their individual entity, have afterwards combined with similar bodies to form district, country or even national federations for the attainment of common advantages. The direct result of these new conditions have been to cheapen and to increase production in the countries concerned; to facilitate and therefore to economise the despatch of the greater quantities of produce available for export".

Miscellaneous—Cattle Breeding Socities.—Animals are greatly used in India for the purposes of cultivation and draught. India's wealth was at one time measured by the number of cows she possessed. She consequently possessed a fairly large supply of good and serviceable cattle; but of late there has been a great deterioration in the quality, and diminution in the quantity, of live stock all over India; and the want of good cattle has been a great drawback in the improvement of agriculture. The necessity of having cattle breeding societies need not therefore be questioned.

Cattle rearing is difficult in those parts of the country in which rainfall is large. Horses are rare in the Karnatic and on the Coromandel coast; in the drier parts on the other hand such as Kathiawar, Sholapur, Khandesh, very good horses are found. But the most important of the Indian animals are bullocks, which are used everywhere for cultivation and draught as well as load. Buffaloes come next in importance, especially she-buffaloes for milk and ghee which are the chief articles of consumption. Sheep and goats, donkeys and camels come next: but these are not used largely for agriculture or load and may not come under this head.

Crop and Cattle Insurance Societies.—It has already been shown that the extreme indebtedness of the agricultural classes is due not so much to usury as to seasonal disasters and epidemic cattle diseases. For, the credit society could supply capital, the supply society could supply seed, manure, cattle and everything; but what society can make good the wholesale loss caused by drought or excessive rain, or by an insect pest or a crop disease? Again, Cattle Breeding societies can supply bullocks, but what society can avert the complete ruin from a cattle disease? All a cultivator's capital, labour, and expense go in a day leaving the hapless farmer a hopeless wreck. Nothing can compare with the ineffable anguish of a totally ruined farmer. The uncertainties of trade, war or even gambling cannot be on a par with the uncertainties of agriculture. And Insurance of crops or cattle is the means which can bring a farmer succour in his helpless condition; Insurance can raise him from utter helplessness to power and strength; Insurance is verily the triumph of humanity over nature; and Insurance gives the farmer security for the future. It is by means of Insurance that a farmer is enabled to form a general plan of conduct; it is by means of this that the successive moments which compose the duration of life are not like isolated and independent points but become parts of a continuous whole. The principle of security comprehends the maintenance of all his hopes. Again, Man is limited to the present time either in enjoyment or suffering but he is susceptible of pleasure and pain by anticipation; it is not therefore enough to guard him against actual loss, by means of a supply society or credit society but it is necessary to guarantee to him, as much as possible, his possession against future losses. All agricultural countries of Europe, aided by liberal State help have secured the agricultural classes from this wholesale loss by the institution of Crop and Cattle Insurance Societies.

The following statistical table of the agricultural Co-opertive movement in different countries, upto the year 1911, is drawn up to show how the movement is flourishing at home and abroad.

No	Names of countries.	Credit Societies.	Supply Societies.	Sale Societies.	Productive Societies.	Other Societies	Total
1	Belgium	568	1070	73	2133	...	3844
2	Denmark	..	15	584	1157	...	1756
3	Germany . ..	15526	2293	444	4334	1889	24486
4	Finland..	...	...	...	287	409	696
5	France	3450	5146	800	1812	948	12156
6	Great Britain and Ireland ...	303	413	43	314	321	1394
7	British India, Coorg and Mysore States.	3145	...	...	...	...	3145
8	Italy	1763	1319	46	1395	...	4523
9	Japan	1864	744	187	...	2354	5149
10	Netherlands	582	1166	345	686	...	2779
11	Norway..	...	...	...	700	...	700
12	Austro-Hungary .	7116	...	69	651	1887	9723
13	Roumania . ..	...	...	..	103	..	103
14	Sweden	...	800	204	1590	28	2622
15	Switzerland	129	150	28	2980	...	3287
16	Servia	615	...	15	181	42	853
17	United States of America ..	20	10350	1800	3000	2554	17724
		35081	23466	4638	21323	10432	94940

The Industrial Exhibition of the Salvation Army in 1912.

A Plea for Cottage Industries.

BY

Rao Saheb T. R. Kotwal

A very interesting exhibition was held in Bombay in October 1912 under the auspices of the Salvation Army. The results obtained by that organisation as shown in the exhibition were so striking that I venture to lay it before the readers of this Magazine, as being of special importance to all interested in the development of rural life. The principal objects of interest were the exhibits of the silk and weaving industries.

People belonging to criminal tribes could be seen on the two days of the Exhibition, going through all the processes of making silk in all its stages. The first was tending the silk worms fed on mulberry leaves, and tending the worms fed on castor plants. Some of these worms were making cocoons The second stage was the reeling of the mulberry silk on the Zanana Reeling Machine, costing Rs. 30/—or on a frame containing several of these, in a line, and turned by the hand power of a boy, when several boys sitting in a row could, each one, reel from his basin. The cocoons used were of the Univoltine breed reared from seed from France. The machine can be had from the Manager of the Sir Louis Dane Weaving School The cocoons were put in tins of hot water and placed over a stove and left to boil, to remove the gummy substance. The water was thrown away and new boiling water was taken in an enamel pot and in which were placed enough cocoons, soaked in a tin of boiling water. A boy then with a bundle of grass kneaded the cocoons and removed the floss on them with his hand, which is called waste silk, and which is exported to Europe and there spun into thread or mixed with Eri silk and the waste of Tussar Silk. After this each boy caught about 6 thread from 6 cocoons and put them through a needle hole and guided them on so as to be reeled and wounded up by the Zanana Reeling Machine. The cocoons could be seen dancing in the basin. When a cocoon was all unwound the boy supplied a fresh one. Several other processes of preparing the thread for

the warp and the woof were being gone through and lastly one could see a boy weaving a thread into a fabric, on a loom, a patent of a Salvation Army Officer.

For the information of the visitors leaflets and pamphlets were distributed giving an idea of the exhibits and the industries represented.

(i) An illustrated paper on the Silk-Worm rearing at the Tata Farm at Bangalore was distributed, reprinted from the Illustrated Times Weekly of 30th August 1911. This shows that the Tata Farm was taken by the Salvation Army in their charge in 1910. The Mysore Government continued their annual subsidy of Rs. 3,000/-. Any one desiring to read an account of the Tata sericulture Farm at Bangalore and all about sericulture in a nutshell cannot do better than read an article in the Agricultural Journal of India Vol. IV, Part I, 1909 by Mr. J. Mollison. He says, "The Farm was started in 1898 to help native rearers to control such diseases as affect Silk-Worms in India, and generally to give technical instructions in growing suitable kinds of Mulberries, in rearing silk-worms, in reeling and preparing it for market. *The little Farm has answered these purposes admirably.*" A month's course was thought enough.

(ii) In the pamphlet "What the Salvation Army is doing in India and Ceylon" in the chapter on Cottage Industries the principal exhibits of the Exhibition will be found referred to. About silk it says, "We have concentrated our attention especially on two varieties of the silk-worm, the ordinary Mulberry-Silk-Worm and the other the Eri variety which feeds on the castor plant. While the work is in its initial stages we have already met with considerable success." There are already five Silk-Farms. Great interest has been aroused in the question and it seems only to be a question of time establishing a great movement along the above lines

(iii) Another important pamphlet distributed was, "The report on experiments by the Salvation Army with French, Italian, Mysore and Eri-Silk-Worms 1911-12". Any one interested in the future of the silk industry cannot neglect or ignore this report. It is hopeful in tone, critical of the past work and the methods of the past workers in the field, a faithful record of what is being done, and full of suggestions for future work.

Acclimatisation of the Polivoltine variety is recommended for the plains and the tropical portions in India, as is being done in Mysore and Bangalore, though the Univoltine variety has been very successfully adopted in Kashmir, at great cost, with seed from France.

(iv) A chart illustrating the life history of the silk-worm with notes of explanation was hung by the side of the table showing various samples of the silk thread of the Muga, Tassar, Eri and Mulberry worm reeled or spun in India and in Europe. Good samples of silk produced and reeled at Indore under instructions of the Salvation Army were kept on the table.

Eri-Silk is carded in Europe. It is spun in the Fujulpoore Settlement of the Salvation Army. They do not use the Pusa Machine but prefer an English Spinning Wheel. Imitations of this made by the Salvation Army can be purchased for Rs. 25/- called "The Sir Louis Dane Spinning Wheel", from the Manager, "Sir Louis Dane Weaving School, Ludhiana, Punjab". A boy can spin three to five tolas on it in a day. Ready thread can be had at Rs. 4-8-0 to Rs. 6-0-0 per lb. Any one who has seen Mukerji's Monograph on silk can see a variety of samples of cloth made of Eri and other silks. Mr. Commissioner Booth Tucker can purchase any quantity of any silk-cocoons for English firms at one to two rupees per pound. This rate is much more liberal than the one of As. 8 offered by the Economic Botanist, Ganeshkhind Gardens, Poona. This rate at any event creates some market for the Eri-Silk Cocoons and the Depressed Class Misson can take advantage of it, as also the poor agriculturist who can get castor leaves or Tapioca leaves. Tapioca was tried with success, in Ganesh Khind, after rearing the worms in the first and second moulting on the castor leaves. I have once reared Eri-Silk Worms on *Chafa* with good results at Talegaon Dhamdhera. I have also reared *Deo-Muga* in my hall as a recreation on the leaves of the Banian tree at Sasvad. Live cocoons or seed for these can be had from the Director of Agriculture, Assam, Shillong. They are fed on Laurel leaves. *Dyed samples of the silk were exhibited.* About the Eri-Silk-Worm the pamphlet remarks, "This is an indigenous polyvoltine variety of a hardy character. It is almost entirely immune from disease. The silk lacks brilliance and cannot be reeled. Hence it does not equal in value the mulberry-silk but it possesses extraordinary strength and durability and the fact that the worm feeds on the castor plant makes it easy to introduce it rapidly and universally

throughout India. This worm seems certain to take the place of the *Tassar.*"

I quote the following remarks showing the optimistic view about silk industry as a Pan-Indian one with great future possibilities. "If success is to be secured in obtaining for India a front rank position among the silk producing countries of the world, a bolder and more generous policy should be pursued instead of leaving to private initiative, the heavy initial and unremunerative expenditures which are absolutely essential for the ultimate success of the enterprise. It is probable that the Kashmir Government have spent more in one year on their industry than all the other Indian Local and State Governments put together have spent in a decade. Any yet here at India's very gates is an industry which would increase her natural wealth and protect her immense village population from the consequences of drought and famine perhaps as effectively as her vast irrigation works and this at an infinitely smaller cost." The opinion of Mr. Commissioner Booth Tucker is entitled to weight as he has taken the advice of European experts before he formed his opinion and expressed it in the report.

About Eri-Silk he says, "We were informed by the experts that there would be a limitless demand for the cocoons at remunerative rates. Unlike the Mulberry cocoons which must be picked loosely for transportation, the Eri-cocoon can be packed closely like cotton-an important consideration. Being spun and not reeled the facilities for spinning it in a marketable form are at present greater in Europe than in India and there seems good reasons for believing that the large export trade may in process of time spring up". As the silk industry occupied a prominent position in the Exhibition, and as my conversation with Mr. Commissioner Tucker Booth and his wife on the subject made a deep impression on me, I cannot help quoting the recommendations and suggestions he makes in chapter VII of the pamphlet. They are :—

(i) A definite policy should be decided upon and resolutely pursued.

(ii) In mountain regions where the winters are severe and in districts where only tree-mulberry is available, it will be best to concentrate attention for the present on the univoltine French variety of mulberry silk, importing fresh seed from France annually on the system so successfully established by Sir Thomas Wardle in Kashmir.

But even here arrangements should be made for introducing bush-mulberry with a view to raising several crops. This can be done in two ways:—

(a) By keeping a portion of the imported seed in cold storage till the time comes for its release, as has been successfully done in Japan.

(b) By introducing healthy, disease-free seed of the Mysore or Bengal polyvoltine variety.

(iii) In tropical regions the polyvoltine indigenous worms should be given the preference, provided that bush-mulberry is available, or that previous arrangements are made for its introduction.

Bush-mulberry planted at the Allahabad Exhibition in November was ready for use in January and February whereas trees are not available for three or four years. In regard to mulberries the introduction of bush-mulberry need not exclude that of trees. The latter need little care, can be grown with or alongside the ordinary crops and require no expense for cultivation, while supplementing the bush-supply, and yielding a crop of leaves at the most important season. The bush-mulberry will need protection from cattle and goats like ordinary field crops.

The training of an adequate and experienced staff of experts is one of the most urgent requisites. It is the recognition of this that has led to the establishment of the silk-farms above referred to and in these and similar institutions it should be possible to quickly give the rough and ready practical training which is required

It is not so much highly trained experts with superior qualification that are required, (though a certain portion of such will be needed as *leaders*) as *the practical training and improvement of the* men who are actually engaged in the business, and who will look to it for the support of their families. To encourage such, seeing that they are invariably family men it will be necessary to offer scholarships or salaries while they are in training. Each district interested in the business should send some men to be thus trained, meeting the necessary expenses.

Where instruction is only desired in silk-worm rearing and in the cultivation of mulberry a brief period of training will suffice. Where reeling is to be included a considerably longer period will be required.

Improvement of seed and protection from disease.—In Bengal seed stations have been successfully established and microscopes distributed and this at a very small outlay on the part of the Government. Silk-worm rearers quickly learn the great advantage of having disease free seed since they are able to raise a much larger percentage of their crop and consequently obtain a much higher price for it.

Next to Kashmir the Bengal Government is the most advance, and liberal in its support of the silk industry, expending, I believe, Rs. 40,000 annually in doing for the rearers what they are obviously quite unable to do for themselves.

The duty of Government in this matter is clearly recognised in all other countries where-silk worm cultivation is successfully carried on.

It cannot be too clearly insisted upon and recognised that the silk-worm industry will never be either self created or self-existant. The laissez faire policy cannot, and never has succeeded in this domain.

Private enterprise should be freely subsidised and encouraged, where it exists, and where it does not, it will be the obvious duty of the local and supreme Governments to inaugurate a definite policy and to follow it up with an adequate expenditure of money, which will be abundantly recouped at no distant date.

In china, which still leads the world, the industry was inaugurated by one of her early empresses, who is to this day venerated as one of the chief benefactresses of her race.

In Japan, which closely follows her lead, no public expenditure is spared which can conduce to the improvement and progress of what has now become one of her leading sources of national wealth and employment. As an illustration the Japanese have just bought a million cocoons from Manchuria, and are advertising for 1,500 Chinese experts to start sericulture in Korea.

In Europe the cult was introduced in spite of climate and other obstacles by Kings and Emperors, with a lavish and yet none too lavish expenditure of money.

If India is to take a leading place, as she easily may, instead of following as at present at the tail end of the procession, a vigorous policy must be inaugurated and sustained and an adequate expenditure cheerfully made, and private enterprise duly supported and encouraged.

I saw the Eri-silk thread, spun on the Pusa Machine, made into fine socks; neckties, sashes and sundry other articles can, I believe, be made.

The socks were made for me by the ladies of the Seva Sadan, Poona and my thanks are due to Mrs. Ramabai Ranade. The Knitting machines should be used to utilise the thread.

Fishing thread and thread for leather work can be made with great advantage. I suggest these as large quantities of cocoons enough for export cannot be collected except on co-operative lines. A visit to the exhibition and conversation with Mr. Commissioner Booth Tucker and the perusal of the literature would make any one hopeful about establishing Eri silk industry, as a cottage industry, suited even for the very poor. I have done it on a small and large scale. The industry may not make one a merchant prince but will add butter or salt or both to the bread earned from other sources. The Bombay Agricultural Department has issued a Bulletin on the subject. The Pusa Imperial Institute has also issued one No. 29 of 1912 and Mr. Lefroy's article in the Agricultural Journal of India Vol. IV No. I on the subject is enough to teach the theory and practice of rearing Eri-silk worms The reader may also refer to Agricultural Ledger No. 19 of 1894. and Notes on Industries of Assam by E. Stack.

I told Mr. Commissioner Tucker Booth what efforts have been made in the past and were being made at present in the matter of sericulture in the Poona District and the Bombay Presidency and asked him if we in the Poona District could go in for sericulture as a cottage industry and he thought it was likely to be a success. The conditions of success he said were enterprise, proper expert skill and sufficient funds and whole hearted persevering efforts with a sufficiently trained class of workers.

Next to the silk industry the weaving industry occupied a large space of the Town Hall. Special weaving looms of the Army's own pattern were kept working. Turkish towels were being turned out of the loom. About weaving two booklets were given to a visitor (1) "The Sir Louis Dane Weaving School for the Punjab, Ludhiana" and (2) "How to start a self-supporting weavery".

These give information as to the work that is being done by the Army among weavers. Managers of Institutions, Schools, Hostels and Clubs are requested to help the Army by placing their orders with them. A similar remark was heard at the Fancy Bazar of the Poona Seva Sadan on behalf of that benevolent institution. I could hear it said that now that students, clerks and gentlemen wear socks and stockings,

they can purchase such articles from institution like the Seva Sadan and help the cause of charity.

On one table one saw several plants of Eucalyptus and a pot of thornless Cactus. There were exhibits of lace drawn thread and needle work. The cassava (Tapioca) plant or its products were not kept in the Hall as it could not be arranged.

A leaflet on "How to plant Eucalyptus" was distributed. A Bulletin on the subject is published by the Pusa Institute No. 23 of 1911. Plants can be had from Saharanpur. Any one desiring to plant these malaria fighting trees should state the condition of the climate of his locality and the Superintendent, Government Gardens, Lahore can recommend to him the particular kind of tree suitable to the climate and locality There are a large number of Eucalyptus trees in the Ganeshkhind Gardens, Poona.

Cuttings of thornless Cactus for planting, which serves as a food for cattle can be had from Salvation Army Danepur Settlement, Jail Road, Lahore. They are sold there. A leaflet as to how to use it, is issued by the Bombay Agricultural Department. On this subject may usefully be read an article in the Indian Trade Journal Vol. VIII, Page 21, Cactus as a fodder crop.

Cassava (Tapioca) was not kept in *the Exhibition* but Mr. Commissioner Booth Tucker asked me to push it on to the notice of the public as a great fighter of famine and a drought resisting plant. I can recommend a perusal of the Government Resolution issued in 1908 by our Government, Agricultural Ledgers Nos. 4, 15 and 10 of 1897, 1900 and 1904 *respectively: an article in the Agricultural Journal of* India on the subject in 1908 and the American Farmer's Bulletin No. 167 of 1903. The Ledger of 1904 gives nearly all the information that one requires. I have planted trees at Dapuri and they have grown well. Cuttings for planting were obtained from the Ganeshkhind Gardens. They can also be had from *Yeuliseu Salvation Army*, Mavelikaral, North Travancore. The roots furnish a good cheap food.

To the above list of cottage industries may be added the artificial cultivation of Lac on *Babul, Palas, Pimple, Vad, Tur, Bor, Shitaphal* and *Kusumb* trees. Bulletin No. 28 issued in 1912 by the Pusa Institute will serve as a good guide but I may as well tell the reader that the *Babul* tree can be inoculated with mother-lac from the *Bor* tree. I have done it successfully in the Poona District. My results

Vondzeia Subterranea.

(Mozambique Beans).

have been published. The Bulletin on Page 20 recommends Babul brood-lac for Babul trees. I have done this also with success. My paper on Lac Cultivation has been published by the Industrial Conference last year In "the Commercial Guide to the Forest Economic Products of India" Lac is mentioned as an animal product of importance and pages 152 and 153 should be read by every one interested in the Lac industry Very useful information about the Babul tree is given on pages 11, 12 of the above book. It will show what a vast field there is for increasing the lac industry. Mr. Stebbing's Monograph on Lac insects, Sir George Watt's Lac and Lac industries, Puransingh's note on the manufacture of Lac and Chemistry of Lac, as also the several articles in the Indian Trade Journal may usefully be read for an advanced study of the subject.

I would further add to the list of possible cottage industries the cultivation of the *Shingada* nut (*Trapa bispinosa*) and Annatto. For information on these one may refer to the Agricultural Journal of India Vol. IV.

The purpose of this paper will be served if the description given here of the Exhibition creates the effect in stimulating the active interest of all well-wishers of India, in what is being done by the Salvation Army, in discovering channels for remunerative labour, by way of cottage industries, for the social regeneration of the lower strata of the Society to supplement the efforts of Government in that direction.

Some Promising Leguminous Crops.

BY

H. M. Chibber, M. A.

IT is well known that leguminous plants of the type to which the pulses and beans belong have the power of utilising nitrogen of the air through the action of the bacteria which form nodules on their roots. Such being the case the more we are able to grow leguminous crops the better for our soils so far as nitrogen supply is concerned. Apart from this consideration addition of anything to our existing list of crops adds to the number of rotation alternatives which is an advantage in itself. Of the advantages of rotation the one in the direction of reducing or controlling plant pests and diseases calls for further remarks in connection with one of the plants dealt with in this note. It is no secret that our cruciferous plants, which yield vegetables, are perticularly liable to aphide-attacks. One of them is *Brassica campestris*, variety *Rapa*, (turnip) which produces a solid spherical tuber. Of the plants described below, one produces a tuber which might replace the turnip in course of time.

India, as we all know it, exports raw agricultural produce, but India also imports here and there the same class of commodity from other countries. One of them is the subject of this note. It is the seed of a leguminous plant growing in East Africa. The seed is called in Bombay market *Mosambi chana*. There is no reason why we should not grow it locally in India. So far as I am aware of it this is not done on a commercial scale uptil now.

I shall now proceed to deal with the individual plants. For illustrations, see the plates. They represent plants grown on the Poona Agricultural College Farm.

Pachyrhizus angulatus.—(Common names Sank-Alu, and Yam-bean). It is a climbing plant of moderate size. Three leaflets go to form each leaf. The middle or odd leaflet has a markedly toothed margin in the upper half. The flower stalks are long and erect raising the flowers above the general level of the foliage. The flowers are formed in festoons or in drawn-out-clusters. They are of a beautiful

Pachyrizus Angulatus.

(*Sank-Alu*)

Early Stage ; Tubber not yet Formed

violet-blue colour. The pods that succeed the flowers are six to nine inches long. They are straight and flat, with slight depressions between the seeds. There are to each pod eight to twelve seeds; they are flat, square at the ends, and light brown. The economic or useful part of the plant is the root. This is formed into a fleshy mass of different shapes. The commonest shape is that of a sphere. Other forms assumed are those of a cone and a spindle. The sphere is usually three to three and a half inches in diameter. The other forms may be six inches or so in length. The tubers are smooth, glossy, and white on the out side. The skin is fibrous and thin. It is lined within by a proteid-layer. The flesh is quite free from woody fibres. It is white and succulent. The chief constituents of nutritive value are sugar and starch. The tubers are eaten either raw or cooked. This plant forms a favourite crop in parts of India which however lie outside the Bombay Presidency. The plant is found to thrive best on a sandy loam. The following account of its cultivation is taken from *Agricultural Surveys No. 2 Sagaing District*, published by the Department of Agriculture, Burma.

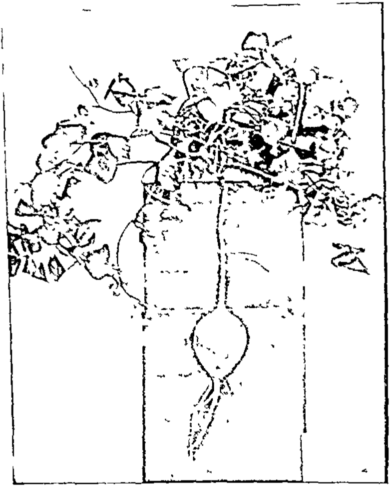
"The ground is carefully harrowed to produce as fine a tilth as possible, and the seed is sown in the months of September—October. Rows are made by the seven toothed harrow and in these rows seed is sown thickly. The distance between the rows is only about ten inches, so that all the space under the crop is practically occupied by the tubers when they form. Two or three weedings may be given. In February and March the tubers are dug up."

Voandzeia subterranea. (Common names Mozambique beans, Mosambi chana)—as the scientific name of this plant implies, its important or useful part is developed underground. But this time it is not the root but the fruit or pod that is formed below ground and is collected for human consumption. The pods are rounded and one seeded. Though formed underground as in the groundnut, they lie very superficially. The crop is not a substitute for the ground-nut; for, oil which is the principal product of the latter is present in only small quantities in the former. It is likely to form a very good supplement to the peas. In Mauritius the leaves are further utilised to feed stock. The crop is also used in the same island as a green manure. The plants form rosettes about six to twelve inches high.

The following table gives an analysis of the beans done by Dr. Harold H. Mann, Agricultural Chemist to the Bombay Government, with figures for lentil (*masur*) reproduced for comparison:—

Constituents of dry seed.	Mozambique bean.	Lentil.
Moisture	2·65	12·95
Ash	3·55	2·69
Cellulose	4·25	3·67
Fats	7·35	0·60
Sugar and starch ..	63·15	58·06
Albuminoids	19·05 *	22·03

* Contains nitrogen 3·05.



Pachyrhizus Angulatus.

(*Sank-Alu*)

(Later Stage ; tuber fully formed).

The Determination of Ripeness in cane.

BY

G. R. Mahajan, B. Ag.,

Manjri Farm.

ONE of the greatest causes of inferiority in the *gul* or *jaggery* produced from sugar-cane is the ripeness or over-ripeness of the cane. There is a point when cane reaches its meximum percentage of cane sugar. Up to this stage, and after this stage the proportion of non-crystallisable sugars is greater, and hence the product made from the juice is not so good as at precisely the right moment. To ascertain when this moment has been reached is a matter, therefore, of great importance,—and though no completely satisfactory method has yet been devised, yet there are certain means which we have employed at the Manjri Farm which give us a better command over the whole operation of cane cutting and *gul* making than we could have otherwise.

So far as this part of India is concerned, canes can be roughly classified into two groups,—thick and thin. The thick varieties in India usually ripen in eleven to twelve months, while the thin ones take only ten months or even less. In the Deccan, the chief variety grown is *pundia*, and next comes *Labirya* (striped cane), while thin varieties, viz. *wansia* and *sannabille* are preferred in tracts where less irrigation water is available. The usual time of planting cane in the Deccan commences from the end of December and lasts to the middle of April. Cane sown in December is ripe for harvesting in the following November, and so on.

The main point to be considered in sugar-cane is to obtain the maximum percentage of sucrose and less of glucose. The average analysis of juice in ripe *pundia* cane such as we grow at Manjri, is as follows:—

Brix Reading	... 20·00%
Sucrose	... 17·50%
Glucose	... 0·75%
Other impurities.	... 1·75%

The total solids in the cane increase gradually reaching a maximum of twenty per cent in *pundia* when about twelve months old. Thereafter it declines. Knowing this we can ascertain with a fair approach to accuracy whether the cane is ripe or not, for *gul* making by a simple determination of total solids. As it has been proved that the ripe stage lasts for only a week or thereabouts after which the glucose value increases and that of sucrose decreases, it is very essential to know the ripe stage in cane, and the chief object of this article is to indicate a cheap and fairly satisfactory method of determining this ripeness.

I will first briefly summarise the methods in vogue among the cultivators —

1. *Colour of leaves* :—This becomes yellow and the whole field has a yellow appearance from a distance. This, however, does not always indicate ripeness as, sometimes, in less manured and light soils, the leaves may turn yellow earlier.

2. *Cessation of growth*.—As the cane ripens, the growth is checked and the shoot either does not grow or grows very slowly. The cultivators' term for this cessation is *radhe julane* (वाढे जुळणे). We cannot definitely tell by this, at what time the cane contains the highest percentage of total solids.

3. *Deepening of colour of the cane skin* —In some varieties, the ripeness may be judged by this test but it does not hold good in case of *pundia* which is always yellowish green.

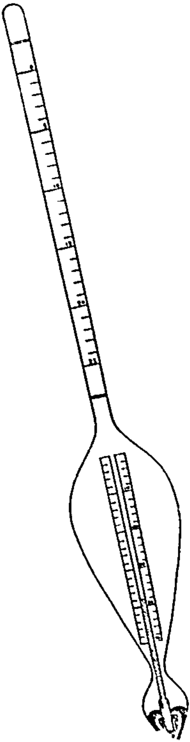
4. *Breaking of the cane at the nodes*.—The cane is held at both ends and bent. If it snaps suddenly at the nodes when a jerk is given, it is taken to be ripe.

5. *Sweetness*.—As the cane ripens, the sugar percentage increases and it tastes sweeter but no definite stage can thus be ascertained.

6. *Development of the eye buds*.—By the cessation of the growth of the leading shoot at the time of ripening the eye buds naturally develope. But in some cases as, for example, when the cane is lodged we see the development earlier.

7. *Sound of the cane*.—The ripe cane gives a metallic sound when struck but this can be experienced even in raw canes exposed to sunlight.

BRICK'S SACCHAROMETRE



8. *Sparkling of sugar crystals.*—If ripe cane be cut obliquely and seen against light, crystals of sugar appear to sparkle, but this too is a minor test.

9. *Obtaining the maximum quantity of "gul"*,—or in other words determining the total solids in the juice. This is done by a very wasteful and laborious process. When the canes are over ten months old, some of them are crushed and if they give a certain quantity of *gul* per unit pan, the canes are judged to be ripe, if not, the coolies must be dismissed and the work stopped.

The above are tests employed by experienced cultivators, and none appear, from their description, satisfactory. The last test is no doubt a sure one but the process is, as I have said, wasteful. Towards Sholapur, where the gang consists of more than thirty men, the owner suffers heavily if he finds the cane unripe. A method similar to the last one but infinitely simpler and less costly is to find the amount of total solids in the juice.

For this, the western cultivators and the sugar manufacturers use a kind of hydrometer. Of the many varieties of this instrument, Ballings or Brix saccharemeter is the best and in general use. It tells directly the percentage of sucrose in the juice. The instrument is graduated on a sugar basis, that is, 16 % Brix or Ballings is indicated when the hydrometer is immersed in a 16 % solution of sugar. It is made of glass and has the shape shown in the accompanying figure. When immersed in a liquid, the hydrometer will sink to a certain point depending on the density of the liquid; the point where the level of the liquid cuts the stem of the instrument gives on the scale the density of the liquid. Owing to capillarity, the liquid rises as much as $\frac{1}{8}$ inch up the stem. The reading must therefore be taken at the lower level.

The instrument is set at 17.50C. and hence corrections have to be made for the reading if the temperature of the juice is above or below this standard, according to the tables supplied by the maker of the instrument. Some instruments have the thermometer fixed within with the figures for correction mentioned. For ordinary purposes, these corrections are negligible.

The method of using the instrument is as follows:—About half a dozen canes are taken from the field and crushed. The juice is filtered through a cloth, poured into a glass vessel,—the hydrometer immersion tube—specially made for the purpose, and allowed to stand for a few

minutes so that all air bubbles may rise to the surface. The tube is filled up to near the brim and when the reading is taken there should be no bubbles adhering to the stem.

The whole apparatus if obtained from any chemist in Bombay would cost not more than ten rupees. The saccharemeter with the thermometer set in, costs Rs. 6/- and the glass tube 12" × 1" about Rs. 2/-. Thus a small inital outlay would save the cultivator the immense trouble which his present awkward methods entail and free him also from guessing more or less the ripeness of his canes.

Notes on the Cottons of Khandesh.

BY

K. D. Kulkarni,

Cotton Supervisor, Northern Division, Bombay.

(In some former numbers of this magazine the author of the present article supplied some very interesting and valuable notes on the cottons of Gujarat. He has now been kind enough to supply similar notes on the cottons of Khandesh, in the form of notes on his own tours in that district.—*Ed.*)

Pachora Taluka.—The first village I visited in this part of Khandesh was Pimpalgaon Budruk, a place noted for cotton and considered to have an exceptionally good soil for cotton.

I saw there pure N. R. being grown in several fields, the purity being as much as 90 % the yellow flower and N. R. C. type being in very small proportion. The analysis of the plants made on the sport showed :—

N. R.	N. R. C.	Yellow flower.	American.
90	5	5	0

After inquiry I learnt that this purity was acquired by some fifteen cultivators by selecting the bolls which opened first, which naturally were of N. R., that cotton being the earliest one to flower.

This selection has been continued by these people for the last five years and the ginning percentage result is also good, being as much as 37 % . So the purity of N. R. and not the deep black soil is the cause of the better value the people get there for their seed cotton. The yield per acre is 350 lbs.

I next visited Mayaji and Kuranji. These two places were known to be famous in the Pachora Market as giving an excellent ginning percentage.

Here it was found that the higher ginning percentage is due to the deep black soil only and no particular type is selected by the people out of the local cotton. The places noted round about Mayaji for cotton are, Kuranji, Varxidi, Dahingaon and Nandra, but all for better ginning due to the deep black soil.

The ginning of these villages is 37 % while the extra price paid to the villagers over Pachora cotton is eight annas per Maund (184 lbs.) more

Recently in these villages some ten persons have been taking special care to pick the early and well opened bolls and their ginning percentage in a good season is as much as 37.5. As at Pimpalgaon Budruk the selection will in the end lead to N. R. type almost pure.

Passing on to Nagardevla village I found that the land is red in colour up to Nagardevla from the station a distance of three miles, while further up it improves slightly in colour, becoming a light black soil.

Here the proportion of yellow flowers is 30 % in the best samples and the general crop has 40 % of yellow flowers, while the proportion of N R. and N R. C is almost equal and the American plants are rarely visible in the fields. The yield, per acre is 250 lbs. The ginning is as low as 34 % on account of the high mixture of yellow flowers though from the mill owners' point of view this cotton will spin "twenties" when the cotton North Khandesh can only spin "twelves" and hence this place is considered by some as a specially good locality for cotton

Here the soil is eighteen inches to three feet deep, below which there is the yellow earth or murum, and at a depth of twenty to twenty five feet there is trap rock and water is usually found.

The rotation here is cotton and Bajri but within the last few years cotton after cotton is being taken on account of the high price of the produce.

From Pachora to Lahore the land is light black soil, except in the middle hilly portion and near Pachora eastwards, where it is red in colour.

Round about Lahore the land is black and the soil four feet deep, below which there is the yellow earth and after twenty feet again there is the trap. The water level here is twenty five feet deep, or more. The proportion of yellow flowers in the general crop is nearly 30 % while the proportion of N. and R. N. R. C. is 55 % and 14 % respectively, the American being only 1 % or less.

The ginning percentage is 35 % and the yield per acre is 400 lbs.

People here do not select their own seed but the merchants take out the first picking of some good crop and gin it separately and sell the seed to the cultivators. The rotation observed here is cotton and *jowar*

but recently they are taking cotton after cotton for three years by ploughing and manuring the fields, while *jowar* is taken then only once.

Chopda Taluka.—The villages noted for good cotton in this Taluka are two in the Chapardi circle and four in the Mungrul circle, though the whole Taluka on account of its deep cotton soil and picking of good bolls for seed purposes by each cultivator is considered the best for seed in the whole of Khandesh. But these villages that are specially noted have got many Gujar cultivators and their method of good cultivation, rotation, thinning and spacing, has caused considerable improvement in the yields and ginning percentage of the local cotton which has got 90 °/₀ white flower the rest being yellow.

Chapardi and Akulkhed :—Akulkheda has got 80 °/₀ of N. R. and 10 °/₀ of N. R. C. while the American plant is only visible here and there.

The ginning percentage will be about 30·5 °/₀. Chapardi has got 70 °/₀ of N. R. and 20 °/₀ of N. R. C. while the American plants are 1 to 2 °/₀ in several fields. The ginning percentage will be about 30. In these two places the yield is 500 lbs. per acre.

In these two places the land is about eighteen inches to three feet deep, below which there is yellow earth mixed with small pieces of Murum and further down Murum again.

In the Mungrul circle the soil is deeper say three to six feet and ploughing, manuring, rotation and thinning are very carefully observed by the Gujar cultivators. These places are also noted for higher ginning and yield, the average yield being 450 lbs. with a ginning of 36 per cent.

Here the mixture of yellow flower is 10 °/₀ in the whloe crop while out of the 90o/o remaining the N. R. type is nearly 80 o/o, N. R. C. 8o/o and American 2°/₀. The rotation followed is cotton followed by *jowar* mixed with *Udid* and sometimes wheat or gram or linseed as a Rabi crop. Besides if cotton after cotton be taken sometimes for the higher value of the crop, they put sufficient manure to improve the land.

So, cultivation, manure and selection of early well opened bolls for seed which are mostly of *N. R.* keep the seed much purer and better in yield and ginning throughout this Taluka than in most other places. In this circle below the deep black soil of three to six feet, there is a murum layer of six feet mixed with yellow earth while below that there is only murum. The water level is nearly fifty to sixty feet deep.

In this Taluka as we go nearer the Tapti river, the land improves in deep black colour, but the banks of the river, half a mile on each side are formed of alluvial soil mixed with small pieces of pebbles and kunkar, and the water level also sinks to seventy-five feet or more. The quality of the fibre of the cotton in this Taluka is in no way superior to ordinary Khandesh cotton so far as length of staple and feel is concerned, but the higher rate of seed cotton is due to the higher ginning percentage due to the higher percentage of white flowered plants The seed merchants generally buy the best lot of high percentage in the market and then sell the seed to the cultivators after ginning the seed cotton separately in the Chopda gins. Some big cultivators of some villages get their best lot of the first picking ginned separately and supply the seed to their own villagers after keeping sufficient for their own use.

Among the people here it is possible to find men who will grow pure N. R. seed, will gin the seed cotton separately and will supply a whole village with one variety.

In this Taluka people understand the importance of selection while the soil also is of good depth and colour, and the rainfall satisfactory.

Chopda:— Round about Chopda the land is very light in colour for a mile while afterwards it improves until there are fields of good deep black soil.

The proportion of white flowers is the same here as the Mungru circle while the ginning percentage is nearly 35. 5 and yield 350 lbs. per acre.

The rotation observed here is the same as the Mungrul circle but wheat and gram are taken rarely here, only when late rains occur, as the soil is lighter than in that circle.

Raver Taluka.—In this Taluka the place visited was Savda where the soil is six feet deep, below which there is the yellow earth mixed with pieces of *murum*.

No kind of selection in cotton is observed by the cultivators here, as among the people of Chopda and thus the proportion of white flowers and the ginning percentage here are less than that of Chopda.

The proportion of N. R. and N. R. C. is equal, about 40 % of each, the proportion of yellow flowers is 18 o|o while the American plants are 2 o|o.

On account of the higher proportion of yellow flowered plants the ginning percentage here is low, about 35·0 while the yield, per acre is 500 lbs. or sometimes less in lighter soils.

Here is a great field for introducing pure N. R. and the higher ginning and better yield which it gives will be much appreciated by the cultivators.

The rotation is the same as that of Chopda, cotton and *jowar* and is being disregarded similarly.

Bhusawal Taluka.—The land of Bhusawal is deep black six feet or more in depth below which there is eight feet of yellow earth mixedwith murum and kunkar and below it murum and then thetrap. There are, however, patches of light yellow soil suitable for garden cultivation, in which there is no trap below within the reach of ordinary digging.

Here the mixture of yellow flowers in the cotton crop is 20 to 25 o/o N. R. nearly 5[illegible] o/o, N. R. C. 10 o/o and American 2 o/o.

On account of good soil and the higher percentage of N. R., the ginning of this locality would have been good but the greater proportion of the yellow flowered plants has diminished the ginning percentage. This only stands about 35·5 o/o but the yield per acre is 400 lbs.

This good yield and tolerably good ginning percentage is better than might be expected though no selection of seed is being observed by the cultivators. Still there are some big cultivators who pick their seed cotton for seed purposes but the ordinary people buy their seed from the Marwari merchants who do not give special attention to higher ginning or better yield nor offer any better price for seed cotton of better ginning percentage.

Yawal Taluka.—Much of the land in the Yawal Taluka is of lighter colour, though the eastern portion is deep black.

The place visited was Sakhali, where the upper earth is three feet in depth of light grey colour mostly mixed with kunkur and below there is the yellow earth mixed with kunkar and pieces of murum. The water is nearly forty feet below the surface.

Here the proportion of yellow flowers is 20% while N. R. and N. R. C. are 60 and 20% respectively. American being less than 1%. The ginning percentage is only 35 while the yield also per acre is moderate 200 to 250 lbs.

There is no system of selecting well opened bolls here for seed purposes but the seed merchants take the seed of the first picking for selling to the cultivators.

Here the rotation is the same as Chopda Taluka and is changed similarly according to seasons.

Jalgaon Tatuka.—Dhamangaon. The land round about Jalgaon is light and rather saltish but from Asoda—two miles from Jalgaon—*upto Dhamangaon on the Tapti river it is deep black*, varying in depth from three feet upwards, below which there is yellow earth mixed with kunkar.

The water level as we go nearer to the Tapti river is deeper and deeper and at Dhamangaon it is nearly one hundred and twenty feet. The proportion of yellow flowers in cotton in this tract is from 15 to 20% and American 2 % while N. R. C. are 45 and 35 % respectively. The ginning percentage is 35 to 35·5 while the yield is 400 lbs. per acre.

The selection is done by some people by getting cotton of the first two pickings ginned separately while the rest buy their seed from the seed merchants without any selection.

The rotation followed here is cotton and *jowar* like that of Chopda but in deep soils some people are taking two crops in a year when there are Rabi rains as this year. Thus gram and wheat are sown this year after *Udid*, *Mug* and groundnut, and even after cotton in some fields.

A Cotton and Groundnut Mixture.

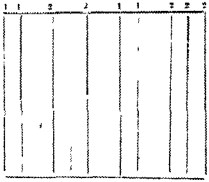
[Translated from the Broach Mitra from the Article by Mr. Chimanlal Harderam].

MIXED cropping is not a new practice in the Broach district. It has been carried out for very many years. Cotton is, for example, commonly grown mixed with rice. The object of such a mixture is to provide a future protection to cotton against heavy rains. Rice requires a large amount of water and so takes up all the excess of water and suitable water conditions for both the crops are maintained.

A second mixture of cotton and *tur* is also common but here both the crops are equally deep rooted and therefore both take nourishment from the sub-surface soil. Therefore a second crop of cotton in the succeeding year may not be expected to yield as much as cotton grown after groundnut.

Advantages of a cotton and groundnut mixture:—

1. Power of groundnut to grow on large as well as on small rainfall :—



1. = Cotton.

2. = Groundnut.

If we grow cotton and groundnut as shown in the accompanying drawing groundnut takes up the excess of moisture as has been found to be the case during the present year.

In spite of the heavy rainfall of this year (about fifty-two inches) the groundnut crop is a very full one (16 annas) and the cotton is also doing well.

Not only does it sustain the heavy rainfall but also does well in scanty rainfall as that of last year (1911) about fourteen inches as it yielded as a sole crop six hundred and forty pounds per bigha (23 pounds* in the Broach district).

2 It allows continuous cotton growing:—Generally cotton is followed by *jowar* which feeds on the surface soil. The sub-surface soil on which the cotton has fed the previous year thus gets a rest for a year. But if we grow cotton and groundnut as shown above the whole field is divided into 2 parts, one under cotton and the other under groundnut every year, cotton following the groundnut in alternate years and *vice versa*. Thus cotton can be grown every year without any bad effect on the fertility of the soil.

3. Its power of increasing Nitrogen in the soil:—The ordinary practice of growing *jowar* in rotation with cotton does not add any manurial ingredient in the soil but only keeps up the fertility by using nourishment from different parts of the soil in different years. But the crop of groundnut affects the soil in quite a different and beneficial way. If we uproot any young plant of groundnut and examine it we find small nodules on roots which harbour bacteria which takes up nitrogen from the air and add to the soil. Thus the soil under groundnut is manured naturally and this has a very good effect on cotton in the succeeding year.

Similarly *Lang*, *val*, peas, *chola*, *mug* and *mataki* add nitrogen into the soil and cotton after *lang* always yields better. This fact is well known to the farmers of the Broach district.

Kinds of groundnut suitable.—There are many kinds of groundnut. Spanish peanut and small Japan grow in the Broach district on rains only without any irrigation, and ripen very early. They give eighty per cent seed in the harvested crop.

Soil.—These kinds can be grown on *Goradu Besar* and medium black soils mixed with cotton. They grow best on *besar* land.

Method of sowing.—The land is prepared in summer as usual and sown after the first rain with cotton and groundnut. Take about

* A standard acre is equal to forty *gunthas*.

fifteen pounds of unhusked pods of groundnut and sow as such through wider tubes of tin on the drill, to save the cost of husking. Some sow cotton as usual by a two coultered drill and groundnut by a three coultered drill in such a way that three rows of groundnut should occupy the same space as two rows of cotton leaving between cotton and groundnut strips sufficient space to allow the harrow to work.

After germination of the groundnut it should be thinned to six inches between the plants in a row. There is no advantage in thinning more as the yield decreases.

Weeding should be done as soon as possible, and then the crop should be intercultured with the "planet junior" handhoe, set with teeth. This loosens the soil and helps root growth of the groundnut. One man can thus interculturate two bighas in a day. This interculture and weeding should be done till flowering begins after which no interculture should be done in groundnut, but the land between the rows of cotton and their sides should be often hoed. The loosening of soil on the sides helps the pod formation and increases the yield of groundnut.

The groundnut sown in June (*Jyesth*) is ready in the middle of October (*Ashvin*). When the plants get yellow one plant should be uprooted and seen whether all the pods are full. If so the plants should be uprooted carefully with the roots. Thus all or nearly all the pods will come out. The plants should then be *dried* in the threshing yard by arranging them in a line with the roots on one side. The pods can be separated by shaking when well dried.

Yield.—The groundnut yields in a mixture about twelve local maunds that is to say 480 lbs. per bigha and the haulm weigh abo twelve to fifteen local maunds that is to say 480 to 600 lbs. The pods sell at the rate of Rs. 2-8/- per 40 lbs. and the haulm at the rate of Re. 1 per 40 lbs. The price for the haulm is the same as that obtained for the haulms of Lang, as they are equally nutritides.

The land should be harrowed after the groundnut is harvested. Then the cotton gets better aeration, light and space and yields about four to five local maunds that is to say 160 to 200 lbs. per bigha, and this sells at about Rs. 5/- per 40 lbs.

Both the crops bring a return of about Rs. 55 per bigha. This outturn is fairly constant year by year. The introduction of the groundnut mixture removes the necessity of frequent fallow, and *jowar* need not be used as a rotation crop.

If we manure groundnut with sheep manure at the rate of five loads per bigha it yields far better. In *goradu* land there is danger of white ants attacking the groundnut, and so, in the monsoon, the field should be manured with four local maunds that is 160 lbs. of castor cake per *bigha* when it is raining.

This mixed crop has been sown for trial in Tham, in the Broach District, and has been found fully successful.

Yield of the mixed crop per bigha.

Seed Cotton.	180 lbs.	Rs. 20 0 0
Groundnut...	400 lbs.	Rs. 25 0 0
Haulms ...	400 lbs.	Rs. 10 0 0
	Total	Rs. 55 0 0

Last year Patel Nathabhai Bapubhai of Chigaspara in the Broach District sowed groundnut alone which was harvested under the supervision of Mr. Rambhai D. Patil, B. Ag. in the bright half of *Ashvin*. The yield was twenty-seven local maunds, *i. e.* 1080 lbs. per *bigha*.

Studies in Vegetable Gland Tissues.—I.

BY

R. Beale.

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(1) *Introduction* :—

Glands of various kinds are found on many plants. Their function may consist of either secretion or excretion. Among plants of the order Euphorbiaceae we find large external glands or nectaries. In this and other orders we find also smaller ones about the real function of which little is known. A study of these latter is to be made in the following articles. Such smaller glands may occur at the base of the petiole and are generally found in pairs They are also found "replacing stipules and in some cases they surmount them, these stipules being in this case laciniate and filamentous. In other cases they are found at the base of the lamina, sometimes occurring on a special lobe of the latter. Occasionally they are shifted higher up on the lamina, two or more of them being present on the lower side of the leaf; they are rarely met with on the upper side, but frequently occur on the leaf teeth. They may be either sessile or stalked. The secretion of these glands is often considerable and lasting; in some cases, however, the glands are only functional during the early stage of the organs in which they occur" (Solereder's Systematic Anatomy of the Dicotyledons Vol. II).

The main reason for examining the internal structure of the following glands was to see if it is in any way similar.

This may show if their functions also are alike.

Among the literature consulted on the subject are Solereder's "Systematic Anatomy of the Dicotyledons" (Boodle and Fritsch) Vol. II and "Plant Anatomy" by Stevens.

The following extract from the former may be quoted :—

"The anatomical structure of these large glands has hitherto been little investigated; the chief work is that of Frombling on the crotonaceae. The author classifies the glands as patelliform and morulose. The shape of the patelliform glands recalls that of the perithecium of

the Discomycetes; the glands may be either stalked or sessile. The epidermis of the lower arched portion has sclerenchymatous walls, and the superficial cells of the somewhat raised margin of the upper disc-shaped portion have a similar structure. The discoid depressed surface of the gland is formed by an epidermis differentiated like palisade and having a sub-cuticular deposit of secretation; beneath this is a second layer of palisade cells with thicker walls, followed by spongy tissue with cells containing clustered crystals and surrounding the termination of a vein. The patelliform glands of the upper side of the leaf of *Micranda bracteosa* Benth, have an analogous structure, but do not project as hairs.

"Monoi examined the nectaries of Ricinus communis L, Crozophora tinctoria, and Homolanthus populifolia. A secretary palisade like epidermis is found in this species also".

A passage from Steven's "Plant Anatomy" may also be quoted:— "*Secretary cells and glands in general.*"

"These are three kinds of glands in regard to their location and form, namely, the superficial type, which, descended from the protoderm is borne at the outer surface and may rise above it in the form of hairs or scales; the interior globular type consisting of a more or less globular group of cells; and the interior tubular type in the form of a tube or canal. Glands belonging to the first type commonly known as glandular hairs arise by the tangential division of a protoderm cell producing a multicellular hair, the apical cell of which enlarges and becomes the secreting cell or a group of secreting cells may compose the gland at the apex. Nectaries are usually of protodermal origin and their cells are frequently elongated radically in the form of papillae."

(2) *Technique.*—The process employed in obtaining sections of these glands for microscopic examination is known as the Paraffin method. It is the most important of all histological methods now in use. It consists first of *killing and fixing*. Usually the same reagent—in this case, Chromeacetic Acid—is used for both killing and fixing. Life must be brought to a sudden termination and fixing is necessary to so harden the material that the various elements may retain their natural condition during all the processes, which follow. The killing and fixing fluids must be taken into the fields, and specimens should be placed therein immediately after cutting. These should not be cut larger than ¼ inch cubes. They may be allowed to remain in Chromeacetic Acid for 24 hours.

Washing.—The fixing solution must next be washed out from the material as completely as possible. Washing should be done with running water if possible. This requires from 12 to 24 hours.

Hardening and Dehydrating.—It is necessary after washing to continue hardening and to remove water. Alcohol is used entirely for these purposes. The presence of moisture interferes with the infilteration of paraffin, hence the necessity for dehydrating. The process must be gradual. The specimen should be passed through the series of alcohol in the following order :—

35 % Alcohol.		
50 % „		for 6 to 24 hours each.
70 % „		
85 % „		

Absolute Alcohol for 24 hours. This should be changed once or twice.

It is next necessary to clear the material. For this xylol is used. The transfer from alcohol to the clearing agent should also be gradual. The following is a good method :—

3 parts absolute alcohol and 1 part xylol		
2 „ „ „ 2 parts „		1 to 10 hours each.
1 „ „ „ 3 parts „		

The transfer from clearing agent to Paraffin should be slow. The most convenient method is to place a small block of paraffin in the pure clearing agent with the material. The paraffin dissolves gradually, six to ten hours being usually sufficient for this step. The material must now be transferred to a paraffin bath for infilteration, which has of course already begun. It is now necessary to get rid of the xylol. This is done by transferring the specimens from the mixture of xylol and paraffin to melted paraffin. The temperature of the bath should be about 58° C. The time required for infilteration varies with the nature of the tissue and the size of the piece. In the glands under consideration infilteration went on over night. The paraffin is poured out into a watch glass, which has previously been smeared with glycerine to prevent sticking. The layer of paraffin should be just sufficient to cover the object and should be cooled as rapidly as possible after the objects have been imbedded.

The paraffin containing the object should be cut into a convenient shape like a block, the surface to be cut being a perfect rectangle. This may now be fixed on the microtome and a ribbon of sections made. As soon as a good radial section has been obtained it should be separated

from the rest of the ribbon and floated on a drop of water on a slide smeared very thinly with egg-albumen, which is applied to make the material adhere. Gentle heating-not sufficient to melt the paraffin-helps to lay the section perfectly flat on the slide, which should be left over night on the top of a heated water bath.

To remove the paraffin the slide should be put into xylol, which should afterwards be rinsed off with absolute and then 80 % alcohol and finally with water.

For the purposes of this research staining was done with Delafield's haematoxylin for 10 minutes. This coloured the cell walls blue. After staining, the section is rinsed in water for 10 minutes, dehydrated in 80 % and absolute alcohol and cleared in xylol.

A drop or two of Canada balsam is put on the section, which is covered with a cover glass.

A label, telling the number of the slide and that of the block from which the section was cut, as well as the thickness of the section and the staining agent employed is fixed on one end of the slide.

(To be continued.)

Agricultural Associations in the Deccan.

BY

V K Kogekar L Ag.,

Organiser, the Deccan Agricultural Association, Poona.

THE utility of Agricultural Associations if properly worked is no longer a subject of dispute. It has been over and over admitted on all sides, that there must exist an organisation, a body, which would serve as a link between the Government Agricultural Department, and the cultivating classes. It is not perhaps too much to say that without the aid of associations it is impossible for the work done by the Agricultural Department to have those wide spread and beneficial results which alone can justify its existence. The individual members of these associations being well-known men in their neighbourhood, men of experience in practical every day cultivation, the ordinary cultivator will listen more readily to these than to any other—expert or official. It is necessary, however, that individual members should work. And where the associations have got these right sort of men, their work has been and is going on well, and is being highly appreciated and followed by the cultivators.

In the Marathi speaking tracts of the Bombay Presidency there are altogether twenty nine Agricultural Associations. Out of these, seventeen are in the five districts of the central Division, *viz.* Poona, Satara, Sholapur, Nasik and Ahmednagar.

I had this year the opportunity, as organiser of the Deccan Agricultural Association, of visiting these associations situated in these five districts. It will be of interest to know their activities, and the general agricultural improvement these are calculated to effect, and the benefits resulting therefrom to the agricultural public.

In all these five districts the Ahmednagar District tops the list in point of the number of Taluka Agricultural Associations it has. This is due to the spirit of organisation that existed in some of the gentlemen who were instrumental in starting that pioneer agricultural association in the Deccan, I mean the Sangamner Agricultural Association. This was the first association in the District and the rest followed its example. This is also due to the agricultural shows which used to be held in this

district almost every year, both at Ahmednagar and in the Talukas by rotation. These shows created a good deal of awakening in agricultural matters, and the people thus came to know the utility and importance of agricultural associations. In some of the Talukas Committees of intelligent, and well-to-do cultivators and land-holders were formed to represent their Taluka at the District shows, and to give their own experiences of any new crop tried, the advantages from any field improvements effected, *e. g.* of *Tals* put up, the use of the Jumper-bar for deepening wells. These organisations afterwards developed into agricultural associations. In others these were formed through the zeal and interest in agricultural matters on the part of local men.

At some places these associations were started at the instance of the central association, which created a good deal of interest in agricultural matters by meetings and other ways among the local men. In certain other places besides the objects of the improvement of agriculture, the organisation was formed for the co-operative sale of farm produce.

In the Satara District, in addition to the regularly formed Agricultural Associations, which are in two Talukas only, in rest of them the District Revenue authorities have *nominated* certain intelligent cultivators from each Taluka and they are often brought together to receive information on agricultural matters, and to this organisation the name "Agricultural Associations" has been given.

From the foregoing it will be seen that under whatever circumstances, these associations might have been started, their main object consists in the improvement of agriculture. The work of these associations until recently was limited to obtaining good seed for distribution amongst its members from the agricultural Department or through it and organising of agricultural shows in the Taluka.

Before dilating upon the practical work these associations are doing it will not be out of place to give a few words about the Deccan Agricultural Association, its relation to these smaller associations, the help it is rendering to these in maintaining their activities and the work it is accomplishing in spreading the knowledge of improved methods to the doors of the cultivators.

This Deccan Agricultural Association or the central body at Poona with its representative membership and the strong co-operation of the experts and officials of the Agricultural Department forms a very influential and useful body in the cause of Agricultural improvement. It disseminates agricultural knowledge, through papers read at its quarter-

ly meetings, by means of its rural meetings held at places away from Poona and by its close touch with the local associations. It publishes an illustrated magazine—*the Shetki and Shetkari*, which goes a long way in furnishing a long felt want, of an agricultural publication of its kind in Marathi, quite fitted to be a friend and companion of every cultivator who can read and write. Furnished with such useful material the Deccan Agricultural association forms the central body for the benefit of the general agricultural public and a stimulating agency for the smaller associations.

Work done by the smaller associations :—A number of subjects which have been proved to be useful by the Agricultural Department, and which can be safely recommended to the cultivators, and are suitable to the particular locality where the Agricultural Association exists are brought before the Agricultural Associations. The utility of these and the benefits that will be derived from them are then discussed in a meeting of the Association, and the cultivators gathered after carefully considering if these new methods are profitable to them, some of them undertake to carry out these on their own farms. Some of the subjects suggested are such as can be followed by any ordinary cultivator without any cost to him and which are within his easy reach. Some which require initial expenditure are taken up by him after having been followed by his more well-to-do and substantial neighbour. Thus at each of the Associations one or more of the individual members follow one or the other of the improvements suggested. These serve as demonstrations to these cultivators of his neighbourhoods who are more sceptical to take to these of their own accord, without seeing them actually done or practised, and proved of decided advantage.

Some of the very useful and simple improvements are. (1) Th proper preservation of cattle manure. (2) The selection of seed. (3) The use of copper sulphate against smut. (4) The cultivation of early maturing and profitable foreign varieties of groundnuts. (5) Cultivation of good yielding varieties of cotton and wheat. (6) Green manuring with San (Tag) for paddy.

The proper preservation of cattle manure and especially urine, which though manurially highly useful is entirely lost sight of in some places. It is not uncommon to find cattle dung carelessly heaped on the ground. In this condition the dung gets dried and loses most of its manurial value. In this connection the storing of dung in a pit and frequently keeping it wet by allowing waste water to drain into it, and

the absorption of urine in dry earth by spreading the same on the byre floor and thus preserving the most valuable manurial ingredient, can be followed without any extra cost. Both these are very simple methods and do not require any great outlay in money but what is required is more work on the part of the cultivators.

Another simple thing within the means of every cultivator and to which no proper attention is given in some places is the selection of seed while the crop is standing in the field. The importance of seed-selection can not be over-rated. There have come out good results from the selected seed as compared with the un-selected seed. There is a possibility of developing particular strains of seed such as early ripening, drought resistant and so on, by following the principle of seed selection every year. In these days of scarcity of rainfall we want early maturing and drought resistant varieties. During my recent tour in the Ahmednagar District, the importance of seed selection with these objects in view was demonstrated on the standing Bajri crop, and some of the cultivators in the Sangamner Taluka have promised to follow the same. This thing like the former does not require any cost, but labour and the desire to do things on the part of the cultivator are the only essentials.

The third thing is the use of copper sulphate as a preventive against smut (*kani* or *kajali*) in *jowar*. In some places smut does such an amount of damage that a cultivator loses sometimes one quarter of his crop. By spending one anna per acre on copper sulphate for seed-steeping the loss resulting from the disease can be totally prevented.

By the cultivation of the early maturing varieties of foreign groundnuts, and good yielding varieties of cotton and wheat, instead of the usual varieties of these crops which the cultivator grows, his income per acre is materially increased.

Other useful subjects and improvements, but which require some investment on the part of the cultivator are, (1) the use of the iron plough, (2) the use of iron sugarcane crushing mill. (3) the use of Poona furnace for preparing gul, (4) the use of artificial manures as top dressing for sugarcane.

The iron plough costs Rs. 30. The utility of this implement has been now proved beyond doubt. The difficulty of its repairs, and the replacing of parts is no more now a difficult thing. These ploughs are also being manufactured here by Messrs. Kirloskar Brothers in their foundry at Kundal Road Station (S. M. Railway). In short all the things mentioned above can be followed by any cultivator and it has

been found that even with the little initial cost, it always pays him in the end to do so.

Besides the knowledge of the improved methods these associations are given information on co-operation in buying and selling, information about the vernacular agricultural schools, where agricultural education is given to the cultivators' sons In this way the smaller associations are stimulated to work and some of these are doing very good work. It won't be out of place to give an idea of the chief lines of work undertaken by some of the associations during the last year.

In the Satara District the Islampur Association demonstrated the use of Poona Furnace for making gul, which has proved to be more profitable than the local one. It has this year applied Ammonium Sulphate as top dressing for sugarcane in the field of one of the cultivators' to show its effect side by side with the ordinary treated plot, for demonstrating the use of top dressing for sugarcane. It has engaged a man who goes round and shows the steeping of Jowar, and the working of the iron plough. Besides this its individual members carry out one or more of the improvements mentioned above.

The Satara District Agricultural Association is going to start, during the *kharif* harvest season, two seed stores for supplying pure seed of the staple crop to the cultivators, while the individual members are following the improvements suitable to them.

The Sangamner Association in the Ahmednagar District is popularising Iron-mots, iron-ploughs, foreign varieties of groundnuts Its individual members have taken to the use of top dressing for sugarcane, the cultivation of foreign groundnuts, selection of seed, the levelling and bunding of fields to prevent washing and so on.

The Jamkhed Taluka Association has maintained two grain-stores.

The Barsi Agricultural Association in the Sholapur District has maintained a small demonstration plot for demonstrating the methods of dry farming, which latter is the chief kind of farming in the District to which this Taluka association belongs.

The Sholapur Agricultural Association has purchased some iron ploughs and is popularising them by their free use to the cultivators.

The growing of profitable new crops, and the use of the iron plough, and its introduction among the cultivators has been undertaken by almost all the associations.

A few individual members from each of the associations, have undertaken one or more of the improvements mentioned above, which serve as so many demonstrations of improved methods to the neighbouring cultivators.

Some of the associations are only of very recent growth and consequently have not been able to collect sufficient funds, to carry on certain demonstrations independently like the Islampur or Sangamner Associations.

From the above it will be seen that in most cases the efforts of the associations, and their individual members are joined together to push on agricultural improvements amongst the cultivating classes. Where the associations have no sufficient funds, to hold such public demonstrations, the work of the individual members with slight help from the association in obtaining good seed for them is also doing a good deal in introducing new things.

On the whole it seems that cultivators are much benefited by such local institutions owing to the general awakening of interest in agricultural matters, and the idea so long held by them that nothing new is possible in agriculture is gradually passing away from their minds, and their views are getting more liberal to adopt new things. This has been observed even in small villages. For the proper working of an agricultural association three things are essential (1) right sort of men, (2) funds and (3) desire to work.

As regards the first point, well-to-do men, who have got lands and who work them themselves are required. Such men can carry on on their own fields the improvements advocated to them. These latter when actually seen by the others are taken up by them.

The secretary of an association should, I think, be a paid man. He may be called assistant secretary and he should work under the elected secretary, who is honorary. It has been observed that the secretaries of associations are some well-to-do gentlemen or professional men like pleaders who have their own things to attend to, and are thus unable to put their whole heart and soul into the work of the association. Under such circumstances the association only remains in name.

Another thing of importance is that, each District Agricultural Association should have the services of an Agricultural

graduate, who should help the Taluka associations in their work. Part of the time of such a graduate will be thus engaged in assisting the Taluka associations, and part can be very well utilized in making an *agricultural survey of the District, which piece of work will be very* useful for the Agricultural Department

Secondly, unless the association has some funds its work will not go on properly. As sometimes before a certain thing (which is intended to be followed by its members) is actually demonstrated and its utility explained it will not be taken up even by an average intelligent cultivator. To do this, therefore, as well as to purchase an implement of proved value for its introduction funds are required Each associa-*tion should have a set of such implements. The most useful, and of* every day use among these are (1) the iron plough, (2) chaff-cutter, (3) leveller, (4) hand hoe. These in all cost Rs. 50. *If* sufficient funds are available, a reaper, a winnower, and a thresher will complete the above list.

The funds required for buying these implements can be raised by means of shares amongst the members and well-wishers of the associa-tion on co-operative principles, and the implements let out on hire. *A beginning on this principle has been made by the* Saswad Agricultural Association, (Poona District) and it has purchased two iron-ploughs with the funds thus raised to begin with.

*Thirdly, desire on the part of the members to do something in-*dividually apart from the demonstrations by the association as a body, is necessary. Unless these three things exist very *little* progress will be made.

The Mutha Valley Co-operative Manure Supply Society, Ltd.

—:-o-:—

THIS Society has been formed in order that the cultivators of the Mutha Valley, Poona District—and more especially the cultivators under the Mutha Valley Canal may by working on a co-operative basis, be able to obtain a supply of concentrated manures at a cheaper rate and of better quality than has been possible in the past. The idea is that the Society is to purchase concentrated manures direct from the manufacturers and from others, in large quantities, at the time of year when castor cake, safflower, cake, fish and other materials are cheapest, store until required for use with sugar-cane and other crops, and sell to its members at a rate which gives a minimum of profits consistent with a sound business position. The society will also be able to guarantee the quality of the materials which it sells, as all materials will be bought on analysis by the Agricultural Chemist to the Government of Bombay.

It is anticipated, on the basis of the prices of past years, that at least ten percent of the cost of concentrated manure will be saved to the members of the Society by this means.

The *Society has been promoted by the Deccan Agricultural* Association. It is floated with a capital of Rs. 20,000 in four thousand shares of Rs. 5/- each. Of the amount of the shares only Re. 1/- will be issued at once, the remainder forming a reserve liability of the members. Only members of the Society will be able to purchase manure from it, and every shareholder will be entitled to obtain hundred rupees worth of manure for each share he holds.

The constitution and bye-laws of the Society have been approved by the Registrar, Co-opertive Credit Societies Bombay Presidency, and its accounts will be subject *to admit by him*. The *bye-laws and certificates* of registration are on view in the office of the Society, and members will be presumed to have inspected these, and to accept them.

The Society has been fortunate enough to secure as its first directors, men of business experience, who are also greatly interested in the development of agriculture in Mutha Valley. These directors are as follows :—

Sirdar Nawroji Pudumjee, C. I. E.—Chairman.

Sirdar Rao Bahadur C. V. Mudliar.

Hon'ble Rao Bahadur K. R. Godbole B. A., M. C. E.

Hon'ble Mr. B. S. Kamat, B. A.

Dr. Harold H. Mann, D. Sc.

N. V. *Kirtane* Esq., Mundhwa

P. K. Tamboowalla Esq., Loni Kalbhor

All applications for shares, or for further information should be addressed to

the Secretary,

POST LONI KALBHOR,
District Poona.

College News and Notes.

IT pains us to send out with this issue—the last for the current year a number of farewells, to many that we have known so well for the past years. And first among them comes our great Patron Lord Sydenham who is soon to retire and leave India, carrying back with him a title which he has earned meritoriously by all the good he has done for the presidency and most of all, we feel assured, by his efforts to advance agriculture We, as members of the institution and department which it was His Excellency's earnest endeavour to improve and augment, feel justly proud of the signal honour conferred on him. We need not enumerate the doings of His Excellency in this connection. Touching us most nearly, is the College which stands as a memorial of the noble intentions of His Excellency and the Deccan Agricultural Association of which His Excellency was the President.

We regret that with our sincere greetings of joy we are obliged to couple a farewell to His Excellency, in view of his approaching departure from among us, and while wishing him and also Lady Sydenham—who has ever been a source of help to him—Godspeed, we pray that they may be spared long to enjoy at home their well earned rest.

We feel hopeful that His Excellency Lord Willingdon who is to come as our new governor will continue the work of Lord Sydenham for agriculture to a still further stage of development. His Excellency has already evinced a deep concern in the affairs of the presidency which he is shortly to govern by presiding at the lecture of Mr. Keatinge and Sir Lee Warner before the Arts Society in London, and undoubtedly a warm welcome awaits him on his setting foot on Indian Shores.

It makes us again feel reluctant to express a prospective goodbye to the many of our senior students that are about to finish their course at the College, by the end of March No doubt we feel it, as College days and ways have made us to intimate with each other. Still we wish them the best of success in the test before them, from March 10th, and after it we should be even glad to hear they are prospering in the wide world.

To the F. Ag. and S. Ag. students also—both University and special we tender our wishes for success and hope that in all the three examinations some names at least, if not all, will shine out as beacons in the first class.

The special students are to have their test commencing in the last week of February. There is a larger number of candidates this year for the three examinations. The short course men are also to submit themselves for the certificate examination, at the same time. There are four students for the Diploma Examination, two of whom are from Ceylon, where on their return we should be glad to see them establishing the fame of the College where they have spent, we hope, three most useful, instructive and pleasant years.

We learn that Dr. Mann is also shortly to leave India on leave, soon after the University Examinations. We would wish that before he leaves he hears of very good results in the University Examinations and then has a happy holiday and one of satisfaction at home.

We have the pleasure of announcing the names of the successful candidates for the Ahmed Mann Medal Competition. The men selected, according to the conditions and rules laid down, were Messrs. Inamdar, Masani and Kurpal for the B. Ag., S. Ag and F. Ag. classes. They all have our hearty congratulations and wishes to earn more honours in the future by their public spiritedness.

Mr. Inamdar is also further to be congratulated on being awarded the Gulabdas Bhaidas Scholarship for passing the highest in the S. Ag. examination last year. This is the first year of award of the above scholarship.

We are pleased also to announce that another prize is to be awarded from this year—called the "Bhatt-memorial prize" for the student that passes the B. Ag. Examination with the highest number of marks in Agricultural Chemistry. The prize to be awarded is a medal and is intended to commemorate the memory of the late Mr. P. J. Bhatt who was a very successful student of the College and who died in Europe in 1911. The prize is the result of funds raised by the friends and admirers of the late Mr. Bhatt and ought to be a stimulus to our students of Chemistry to gain distinction by striving hard for it.

The students of the three classes were taken for a demonstration to the Manjri Farm by Prof. Knight, in January, to study the methods of cane juice pressing and the manufacture of *gul*. Prof. Tryan of Queensland who is on a visit to India to make a study of fungus diseases in India was also present and gave several practical lessons in mycology. He also addressed the students and expressed his high

appreciation of the methods of demonstration and study of agriculture that he had seen on the farm and at the college.

The student's quarters are very nearly ready and in all probability will be occupied by the students in June. The eagerness, with which the completion of the building was being looked for, seems just now to be in a state of suspended animation possibly because it is a problem to many—especially some of our stout gentlemen who are room mates in pairs how to make themselves comfortable and not to encroach on each other's toes in the apparently small rooms.

The Library is being daily improved in its equipment of books and in consequence is getting a larger number of students to it, who like to spend some time occasionally in reading there. It would materially add to the help of the students if a little more of sitting accommodation were provided. Just now, during the examinations, the windows of the library are seen to provide seats to those that happen to miss the accommodation of the few chairs that are there. And it makes one's flesh creep to see from the farm so many men on the windows in an attitude as it were of jumping down through sheer despair of finding where to rest their weary limbs.

LIST

OF

Books, Journals, Bulletins &c., &c. in the Library

OF THE

Poona Agricultural College,

ON

Tobacco and Rice.

List of Books, Journals, Bulletins &c., &c., in the Library of the Poona Agricultural College.

ON TOBACCO.

A.

Anonymous.

1. De Tabak uit de Netherlandsche Kolonien. *Amsterdam* 1883 .. .. A. 210
2. The Cultivation and Curing of Tobacco in Bengal. *Calcutta* 1874 ... . A. 209

B.

Benson C.

The Cultivation and Curing of Tobacco as followed near Dindigul, Madura District. (*Dept. Agric. Madras. Vol. III Bull.* 53) *Madras* 1905 ... ... J. 24

Bijlert A. Van.

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